Acute Coronary Syndrome

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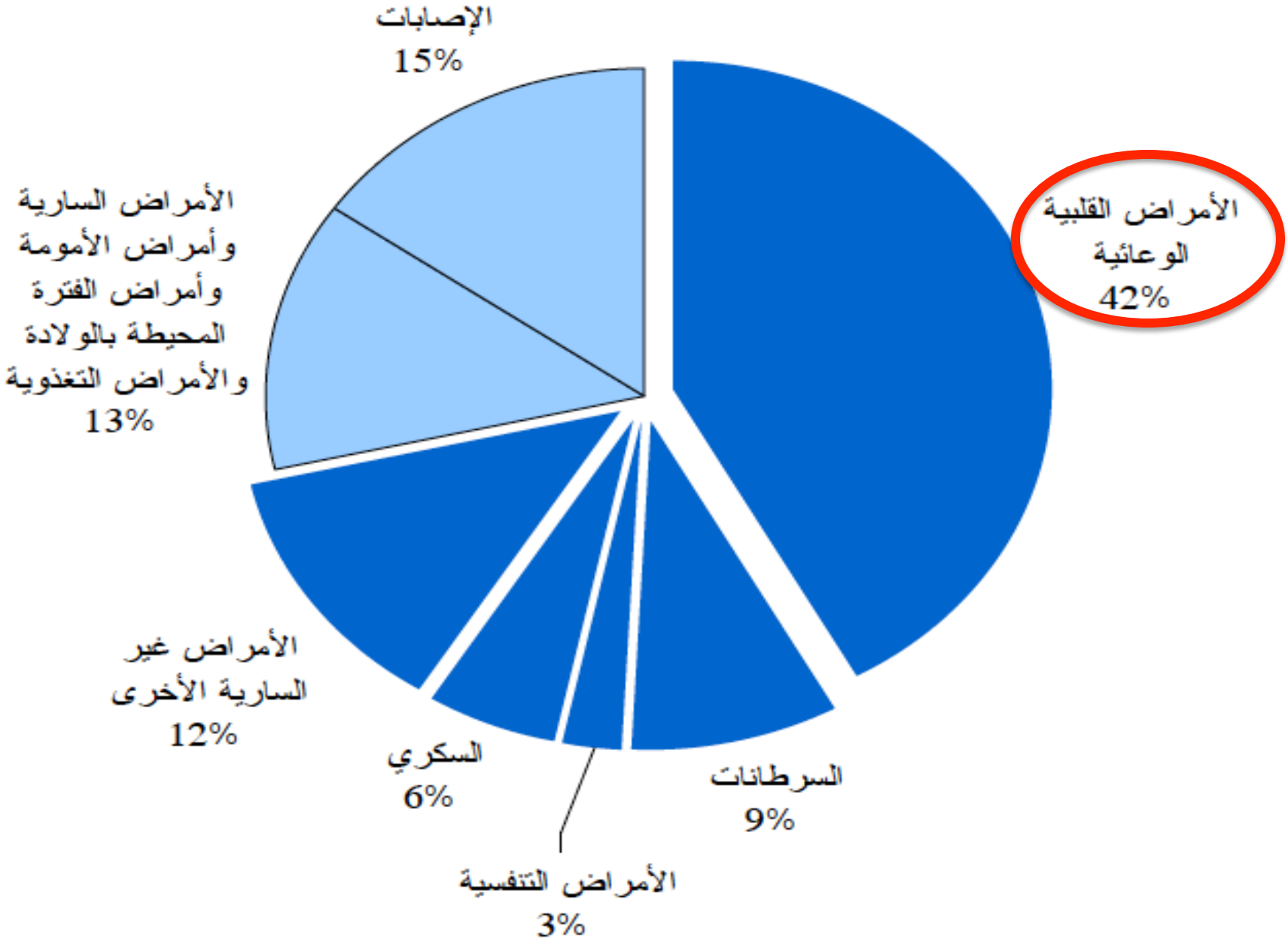
Cardiac Sciences Department

Why is Acute coronary syndrome important ?


الإصابات
15%
الأمراض السارية
وأمراض الأمومة
وأمراض الفترة
المحيطة بالولادة
والأمراض التغذوية
13%
الأمراض القلبية
الوعائية
42%
الأمراض غير
السارية الأخرى
12%
السكري
6%
السرطانات
9%
الأمراض التنفسية
3%

Morbidity and mortality rates of CAD in selected regions for 1990, estimated morbidity and mortality rates of CAD in selected regions for 2020, and projected increase in mortality from CAD from 1990 to 2020, for men and women

	Men			Women		
Region	**1990 (millions)**	**2020 (millions)**	**Projected increase in mortality (%)**	**1990 (millions)**	**2020 (millions)**	**Projected increase in mortality (%)**
Established market economies	390	434	46	40.7	45.5	32
India	439	608	127	41.0	58.9	114
China	585	727	108	54.8	72.1	79
Sub-Saharan Africa	252	555	144	25.8	56.5	116
Latin America	222	331	144	22.3	33.6	141
Middle East	256	496	171	24.7	48.7	148

30% of ER admissions are cardiac

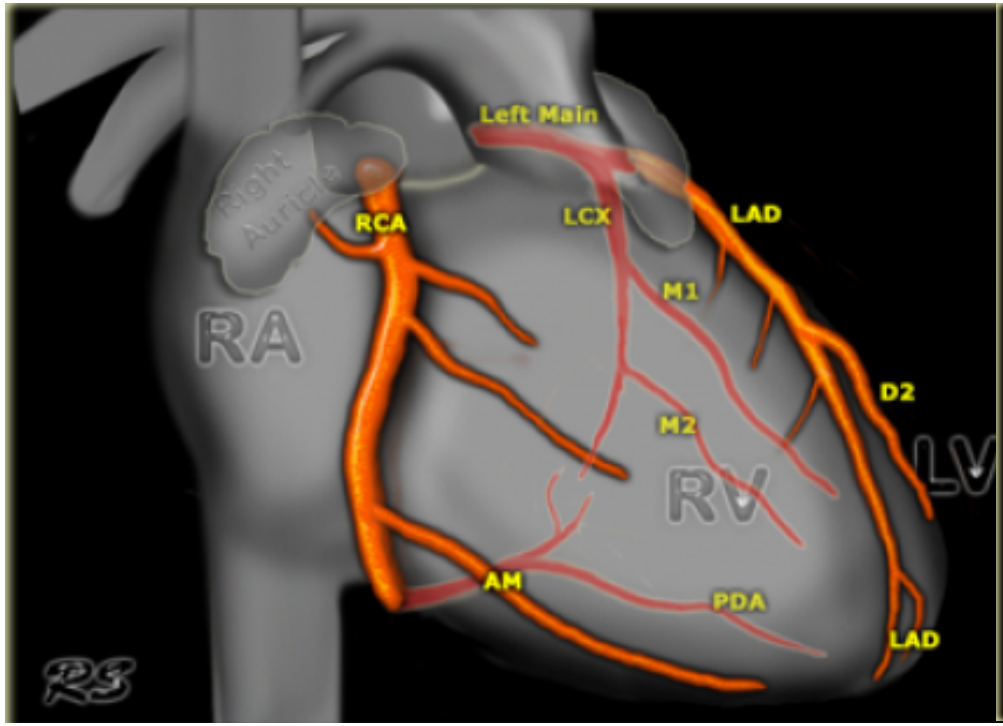
Objectives

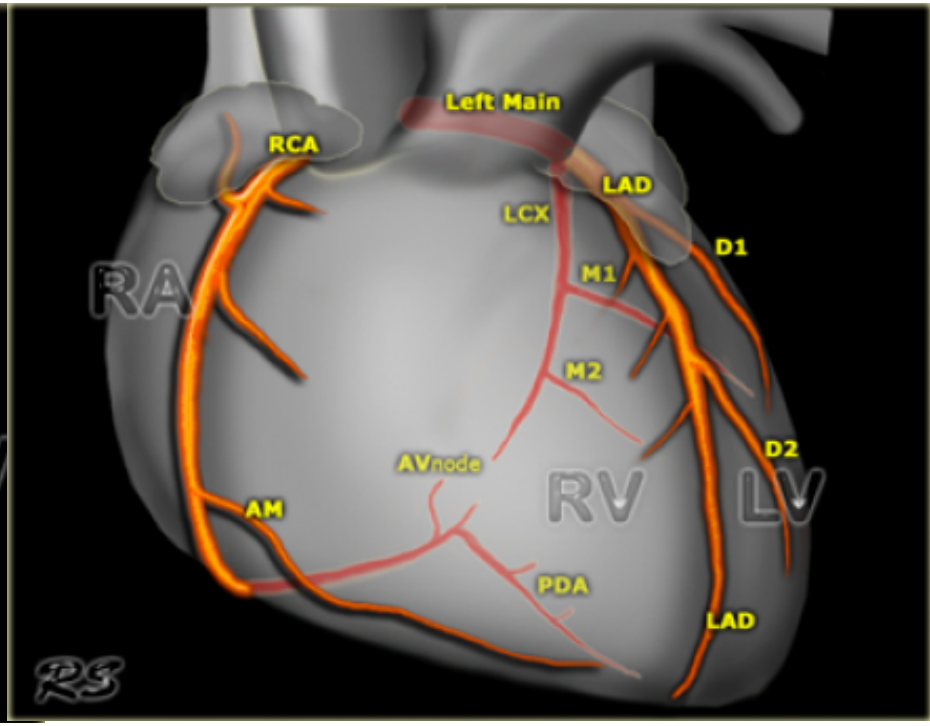
- Pathophysiology of ACS- How?
- Classification of ACS- How to label?
- Diagnostic workup- Recognize it?
- Initial management- Save a life?
- Common complications of ACS- The aftermath?

Resources

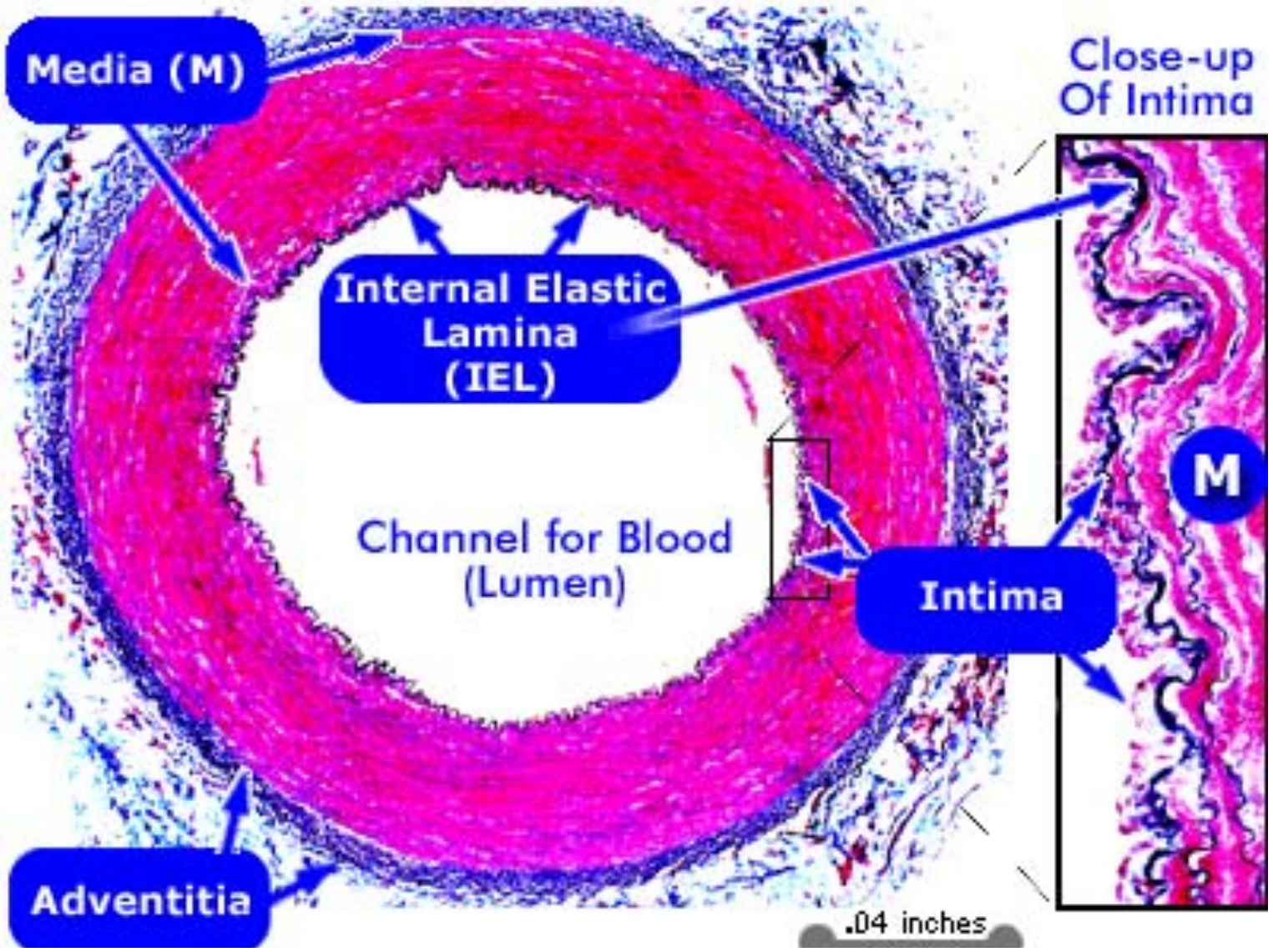
- Davidson or Kumar
- Lecture
- Supplementary articles

What are coronary arteries ??





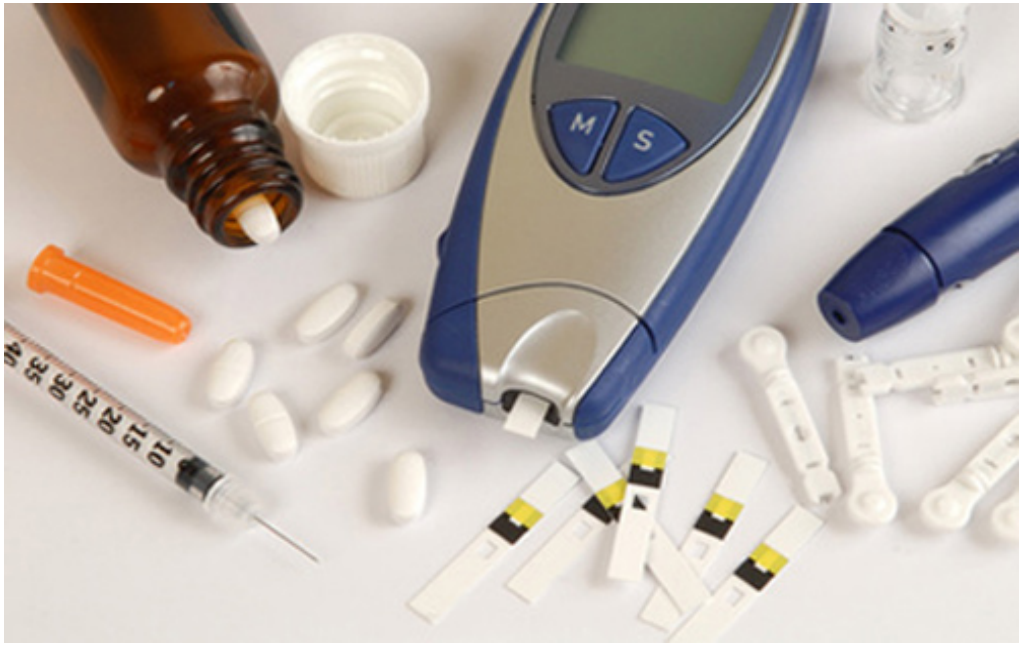
Artery histology



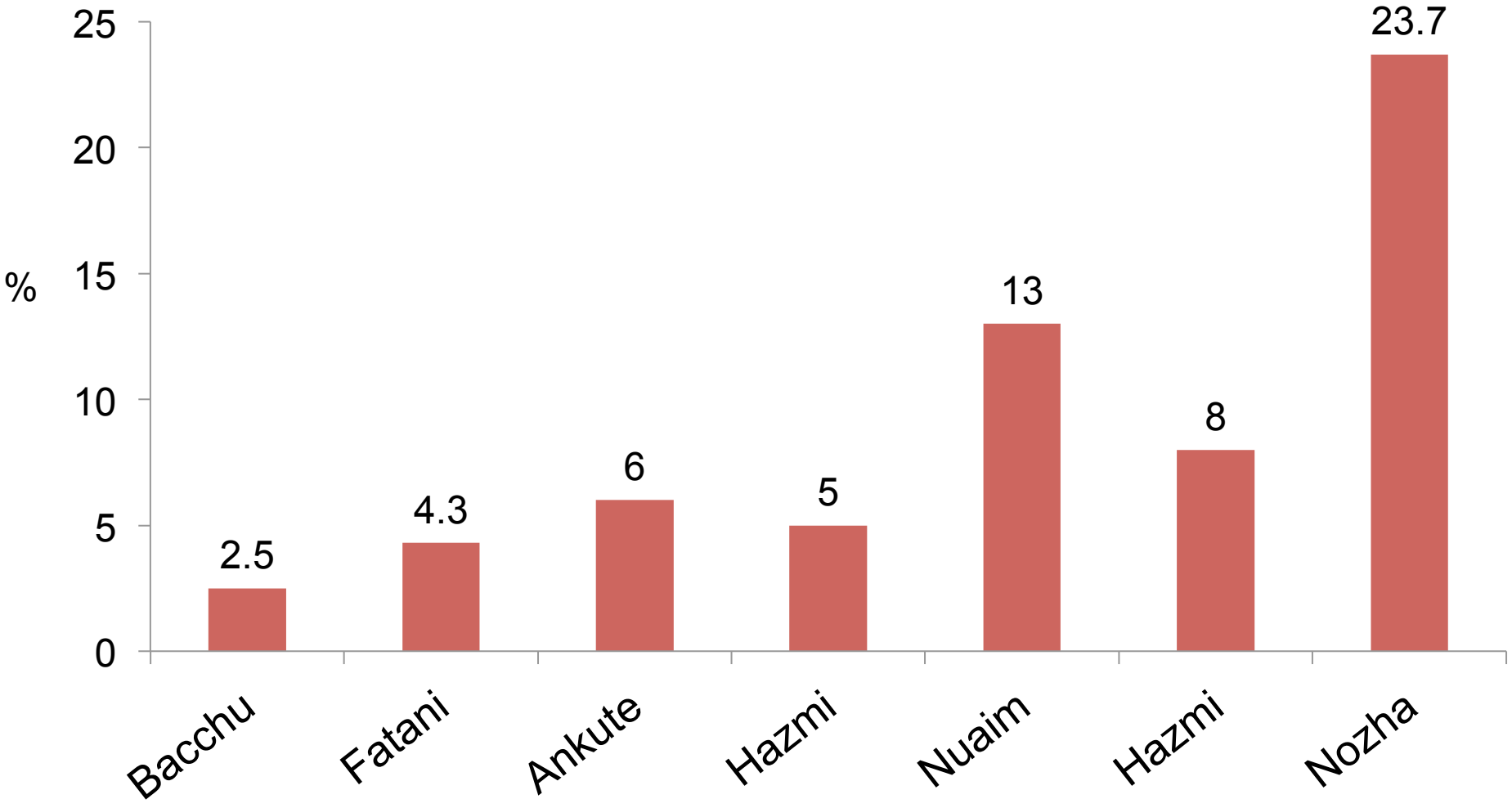
What are the risk factors for CAD?

Diabetes Mellitus

One of every 4 Saudis has DM



Overall DM Prevalence in Saudi Arabia



Elhadd et al Ann Saudi Medicine 20

Hyperlipidemia

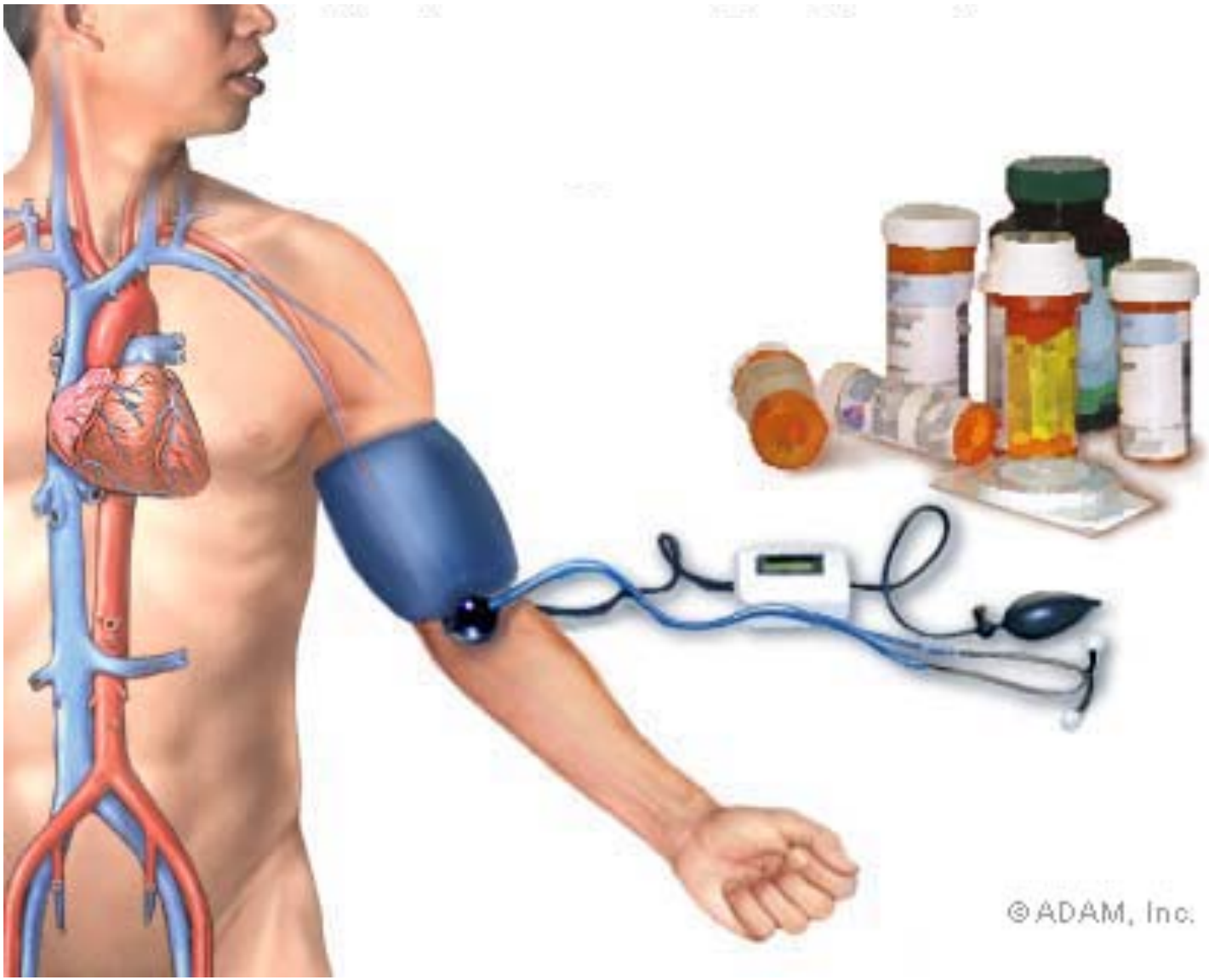
Obesity

Factors	Male %	Female %	Total %	p-value
Overweight (BMI=25.1- 29.9 kg/m2)				<0.0001
Crude prevalence	42.4	31.8	**36.9**	
95% CI	(41.3 - 43.5)	(30.8 - 32.8)	**(36.2 - 37.6)**	
Adjusted by age groups*	42.3	31.8	**36.6**	
Obese (BMI ≥30 kg/m2)				<0.0001
Crude Prevalence	26.4	44.0	**35.6**	
95% CI	(25.5 - 27.3)	(43.0 - 45.0)	**(34.9 - 36.3)**	
Adjusted by age group*	26.3	43.6	**35.5**	
Mean body mass index (BMI)	27.49 ± 5.01	29.64 ± 6.23	**28.61 ± 5.78**	<0.0001

AlNozha et al, Saudi Med J 2005; Vol. 26

Smoking

Hypertension



Other Risk factors

- Age : males ≥45, females ≥55
- Gender (Male gender)
- Family history of Premature CAD: males ≤55 females ≤65
- Stress ???

Role of genetics??

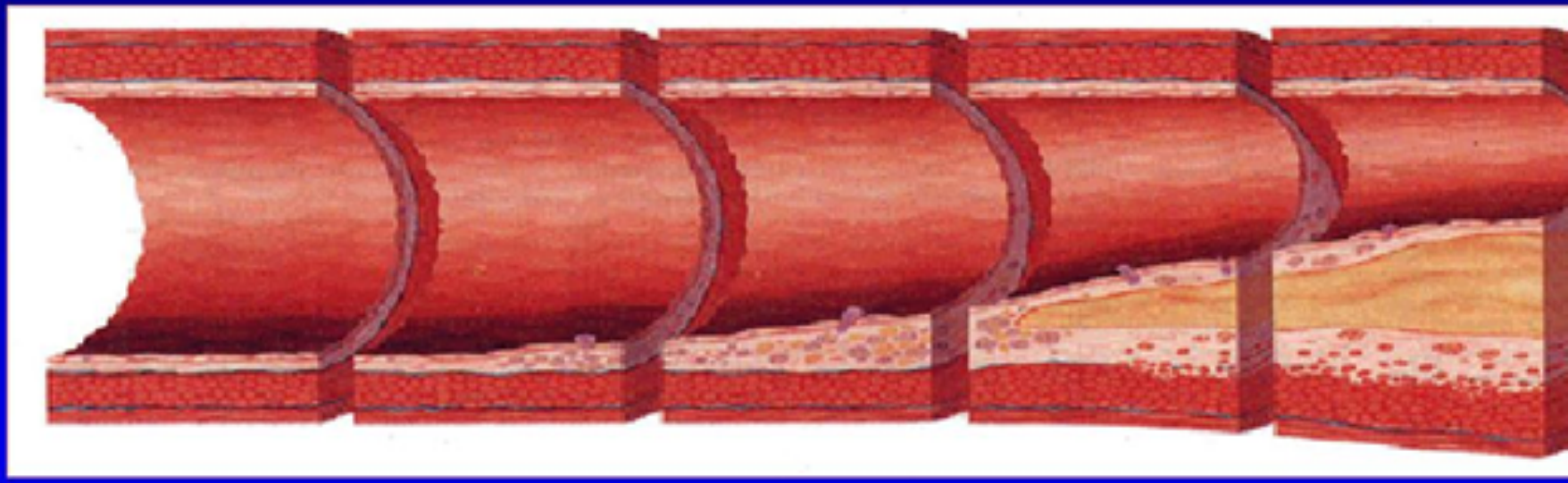
Known modifiable risk factors explain >90% of the occurrence of MI in populations around the world

WHAT IS HAPPENING TO RASHED?

Atherosclerosis Timeline

Endothelial Dysfunction

Foam Cells | Fatty Streak | Intermediate Lesion | Atheroma | Fibrous Plaque



From first decade

From third decade

From four

Growth mainly by lipid accumulation

Smooth muscle and collagen

Stary et al. *Circulation*. 1995;92:1355-1374.


Tissue
Demand
O2
Supply

Angina Pectoris

The remarkable facts, that the paroxysm, or indeed the disease itself, is excited more especially upon walking up hill, and after a meal; that thus excited, it is accompanied with a sensation, which threatens instant death if the motion is persisted in; and, that on stopping, the distress immediately abates, or altogether subsides; have . . . formed a constituent part of the character of Angina Pectoris

John Warren, 1812

Chest Pain description:

- Location and radiation
- Character
- Onset and duration
- Aggravators and relievers
- Severity
- Associated symptoms

Classification of Angina (Ischemic CP)

Clinical Classification of Chest Pain

Typical angina (definite)

1) Substernal chest discomfort with a characteristic quality and duration that is 2) provoked by exertion or emotional stress and 3) relieved by rest or NTG.

Atypical angina (probable)

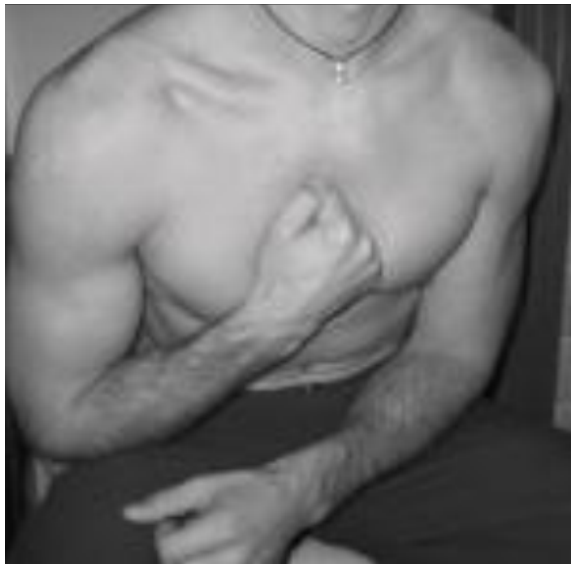
Meets 2 of the above characteristics.

Noncardiac chest pain

Meets one or none of the typical anginal characteristics.

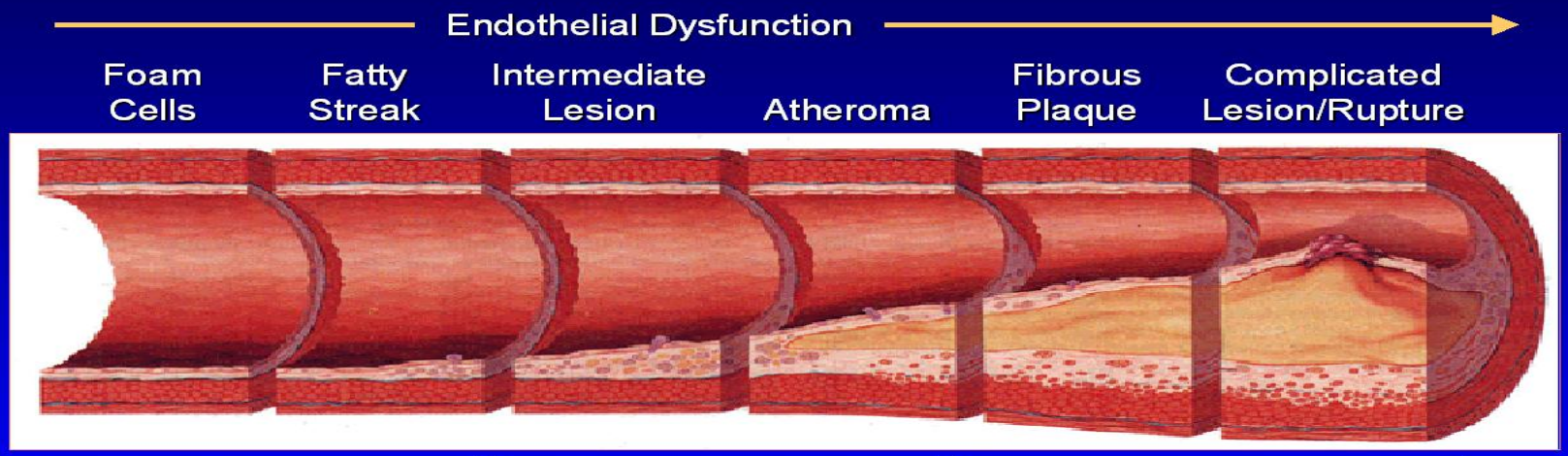
Modified from Diamond, JACC, 1983 (45).

- 12 MN: Severe central crushing chest pain
- Perfuse sweating and nausea
- In ER
  - HR 110bpm
  - BP 180/100
  - O2 Saturation 95% on RA
  - PE was normal

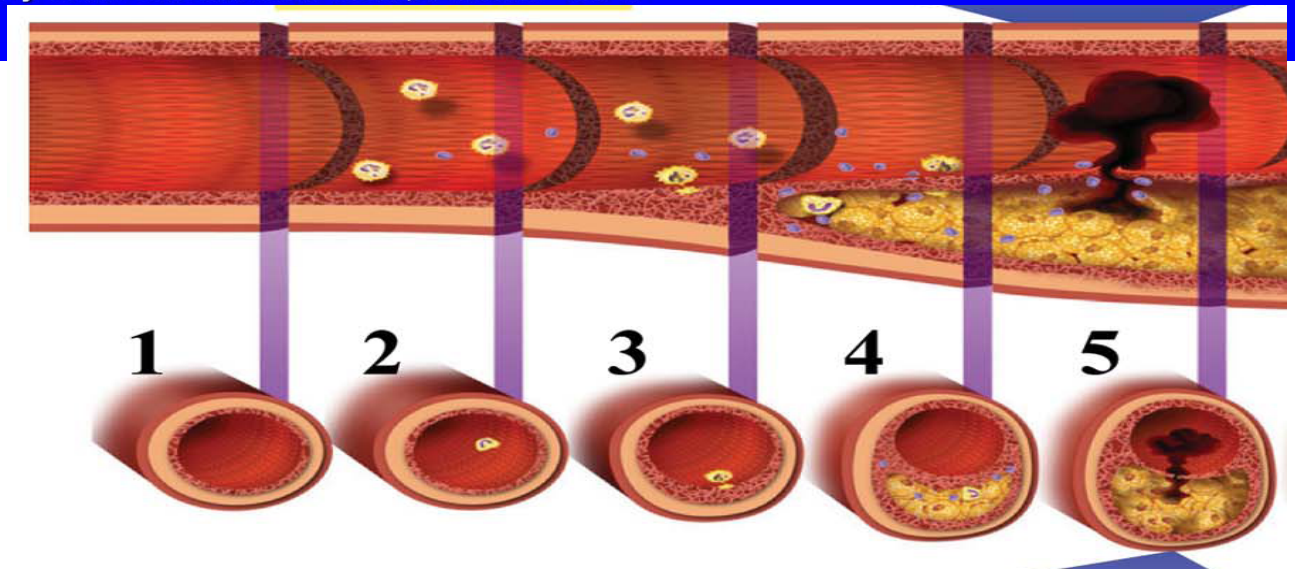


What happened to Rashed on August ??

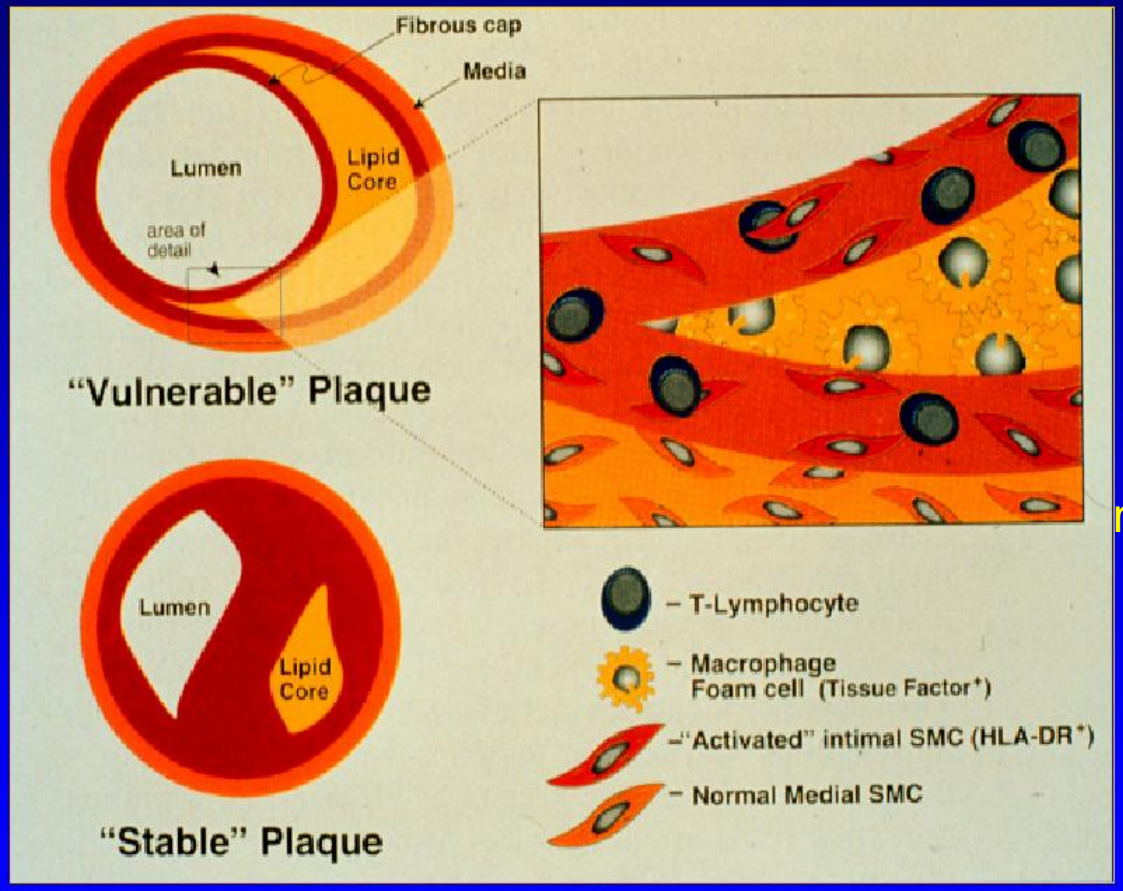
Atherosclerosis Timeline



Stary et al. *Circulation*. 1995;92:1355-1374.



"Vulnerable" Plaque and "Stable" Plaque

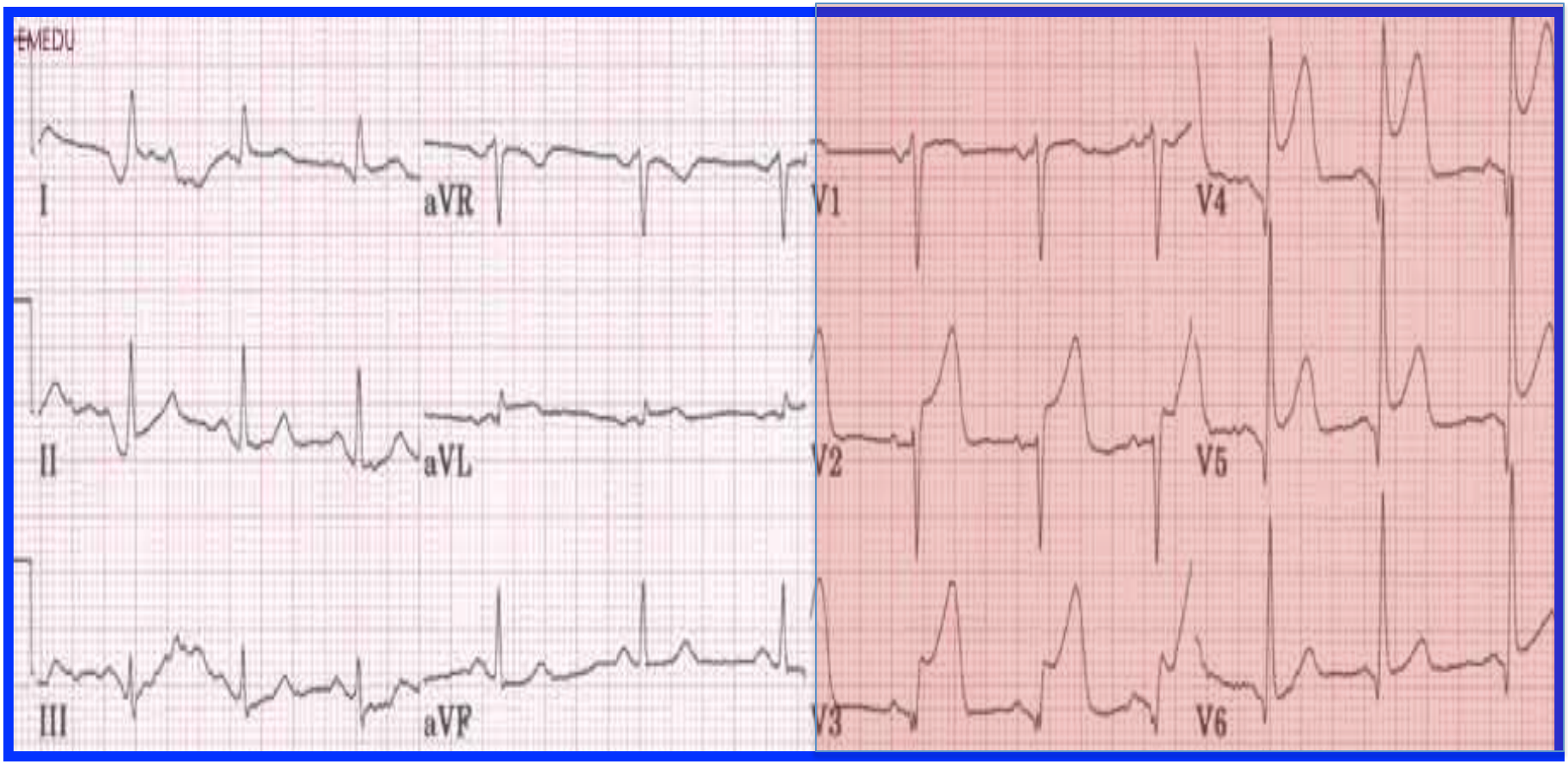


Secretion of Matrex metalloprotenases

Libby. *Circulation*. 1995;91:2844-2850.

INVESTIGATIONS IN THE EMERGENCY ROOM

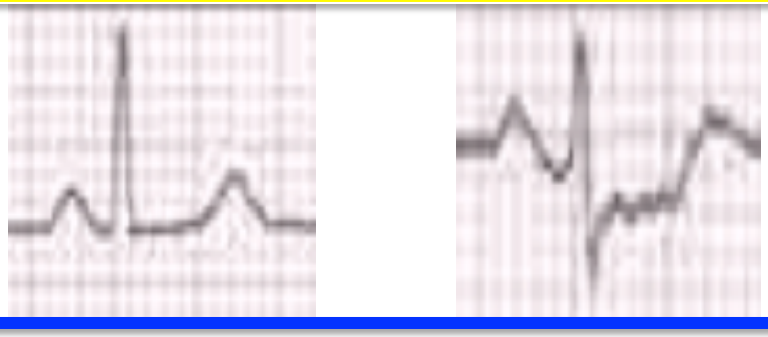
ST- Elevation Myocardial Infarction



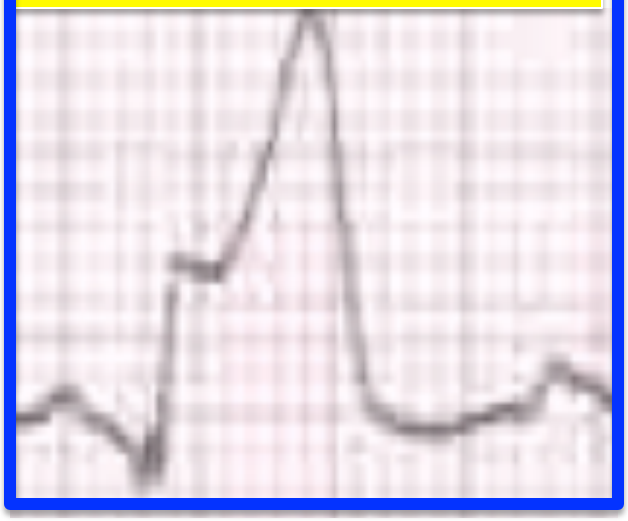
Acute Coronary Syndrome

ECG

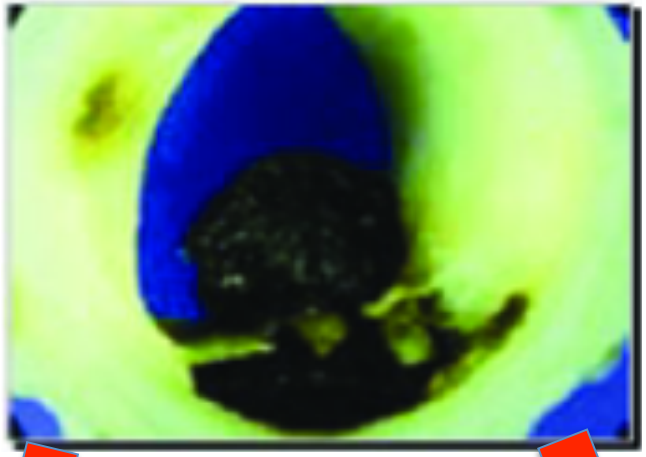
Non ST Elevation Acute coronary syndrome (NSTACS)

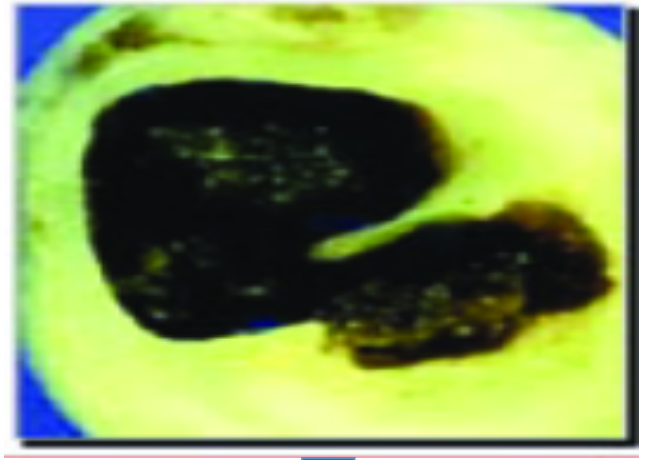


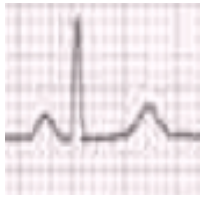
ST Elevation Myocardial Infarction **(STEMI)**



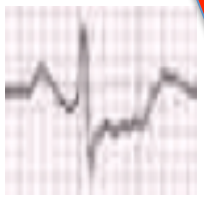
Acute Coronary Syndrome

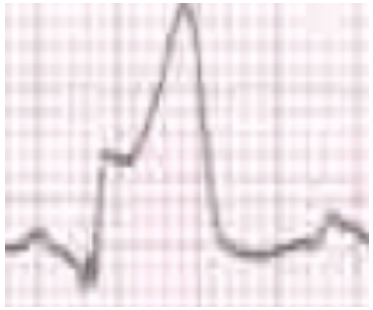






OR





Unstable Angina

No Myocardial Necrosis

Non ST Elevation MI (NSTEMI)

Myocardial Necrosis

ST Elevation Myocardial Infarction **(STEMI)**

Non ST Elevation-Acute coronary syndrome

NSTE-ACS

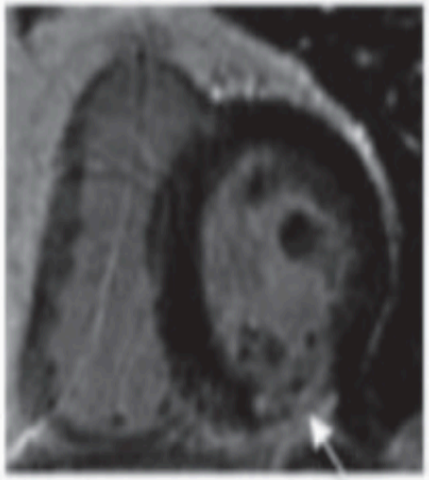
What is Myocardial Infarction?

Fourth Universal Definition of MI

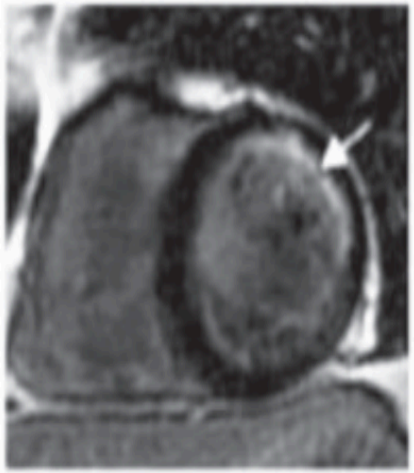
- Typical rise and/or fall in **cardiac troponin T or I** with at least one of the following:
  1. Ischemic symptoms
  2. Pathological Q wave on ECG
  3. Ischemic ECG changes (e.g ST elevation or depression, new LBBB)
  4. Imaging evidence of new loss of viable myocardium or a new WMA
  5. Identification of an intracoronary thrombus by angiography or autopsy.

Cardiac MRI imaging

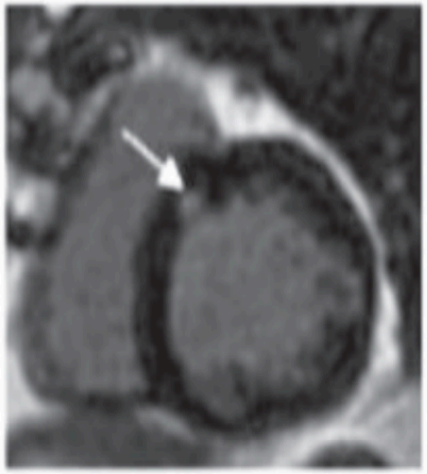
Transmural



Subendocardial



Focal Subendocardial



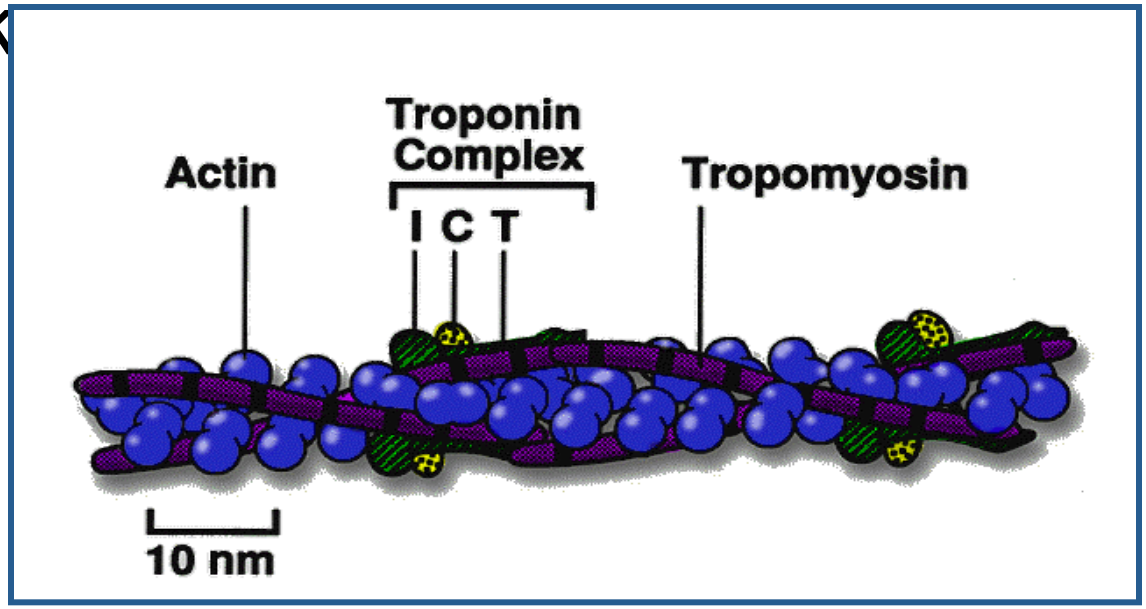
MARKERS FOR MYOCARDIAL NECROSIS

Creatin Kinase (CK)

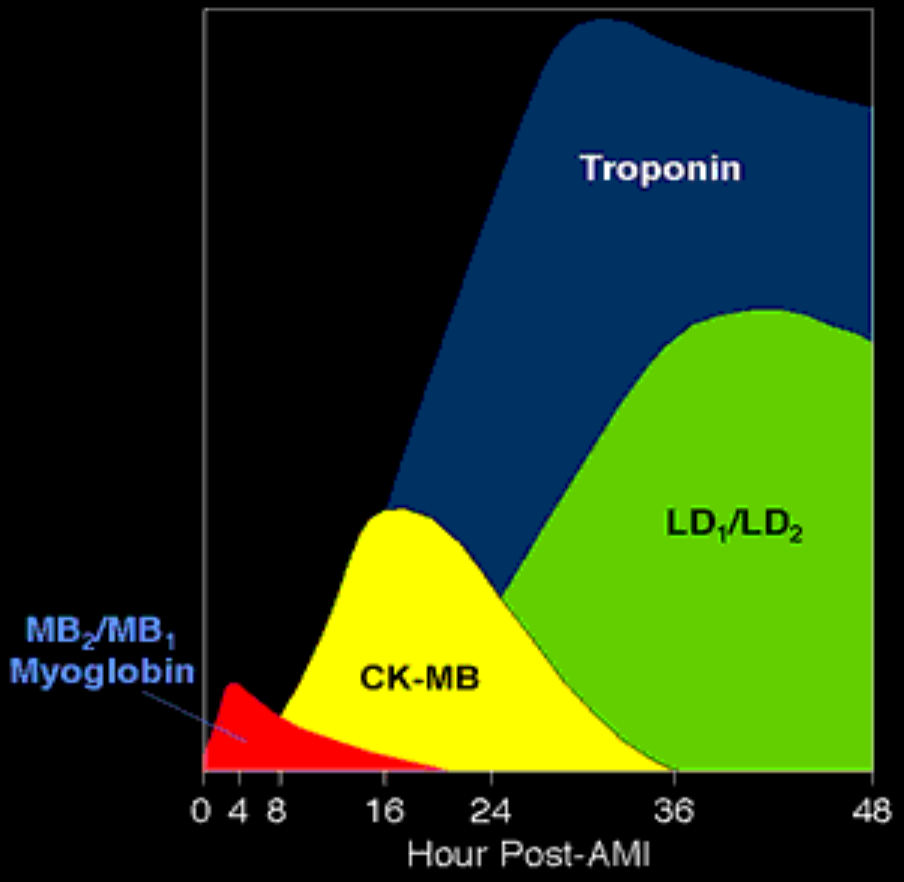
- MI causes release of certain enzymes and proteins into the blood stream.
- Creatin Kinase (CK) is released from multiple organs such as the myocardium , skeletal muscles, and the brain.
- The Iso-form CK-MB, is cardio-specific
- Starts to rise 4-6 hrs after onset of ischemia, then falls within 48-72hrs.

Troponin

- Cardiospecific proteins Troponin I, and T are the most sensitive & specific markers for myonecrosis.
- Released with 4-6hrs, but can last upto 2 week



Relationship between onset of MI and release of markers



Aims of therapy for ALL ACS patients

- Improve oxygen supply
  1. Supplemental O2 (ONLY if O2 Sat <95%)
  2. Coronary vasodilators (Nitroglycerine)
  3. Antiplatelet agents
  4. Antithrombotic agents
  5. Percutaneous coronary intervention (PCI)

Aims of therapy

- Reduce O2 demand
  1. Beta blockers
  2. Analgesics (Morphine) for pain control
- Other medications
  - ACE inhibitors
  - Statin therapy (Pleiotropic effect)

Reperfusion therapy
(Only for STEMI)

a. Fibrinolytic therapy
b. Primary Percutaneous coronary intervention (PPCI)

Reperfusion therapy

Fibrinolytics

- ONLY USED FOR STEMI (NOT NSTEMI)
- Reduces short and long term mortality
- Should be given during a 12hr window, and given ASAP.
- 2 types of fibrinolytics:

1. Non Fibrin specific (Streptokinase)
2. Fibrin specific

Fibrin specific agents

Characteristic	Alteplase (t-PA)	Reteplase (rPA)	Tenecteplase (TNK)	Lanoteplase (nPA)
Immunogenicity	No	No	No	?
Plasminogen activation	Direct	Direct	Direct	Direct
Fibrin specificity	++	+	+++	+
Plasma half-life	4–6 min	18 min	20 min	37 min
Dose	15-mg bolus plus 90-min infusion up to 85 mg	10+10-MU double bolus 30 min apart	±0.5 mg/kg single bolus	120 KU/kg single bolus
PAI-1 resistance	No	?	Yes	?
Genetic alteration to native t-PA	No	Yes	Yes	Yes
	Recombinant version	Finger, EGF, and kringle-1 regions deleted	2 single amino acid substitutions in kringle-1 and substitution of 4 amino acids in catalytic domain	Finger, EGF regions deleted and glycosylation sites in kringle-1 domain modified

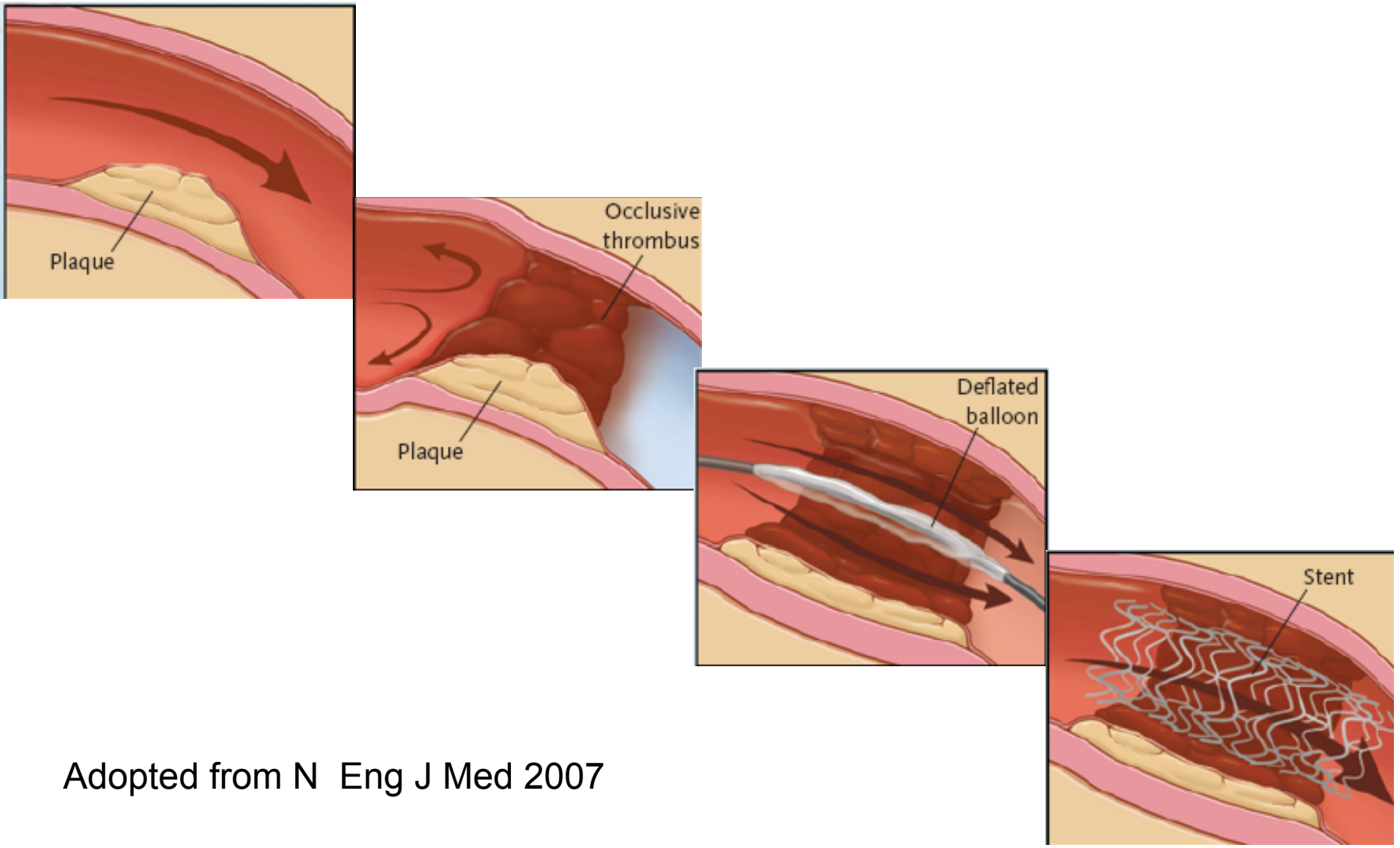
Absolute contraindications

- Any prior intracranial hemorrhage
- Known structural cerebral vascular lesion
- Known intracranial neoplasm
- Ischemic stroke within the past 3 months (except for acute stroke within 3 hours)
- Suspected aortic dissection
- Active bleeding or bleeding diathesis (excluding menses)
- Significant closed-head or facial trauma within 3 months

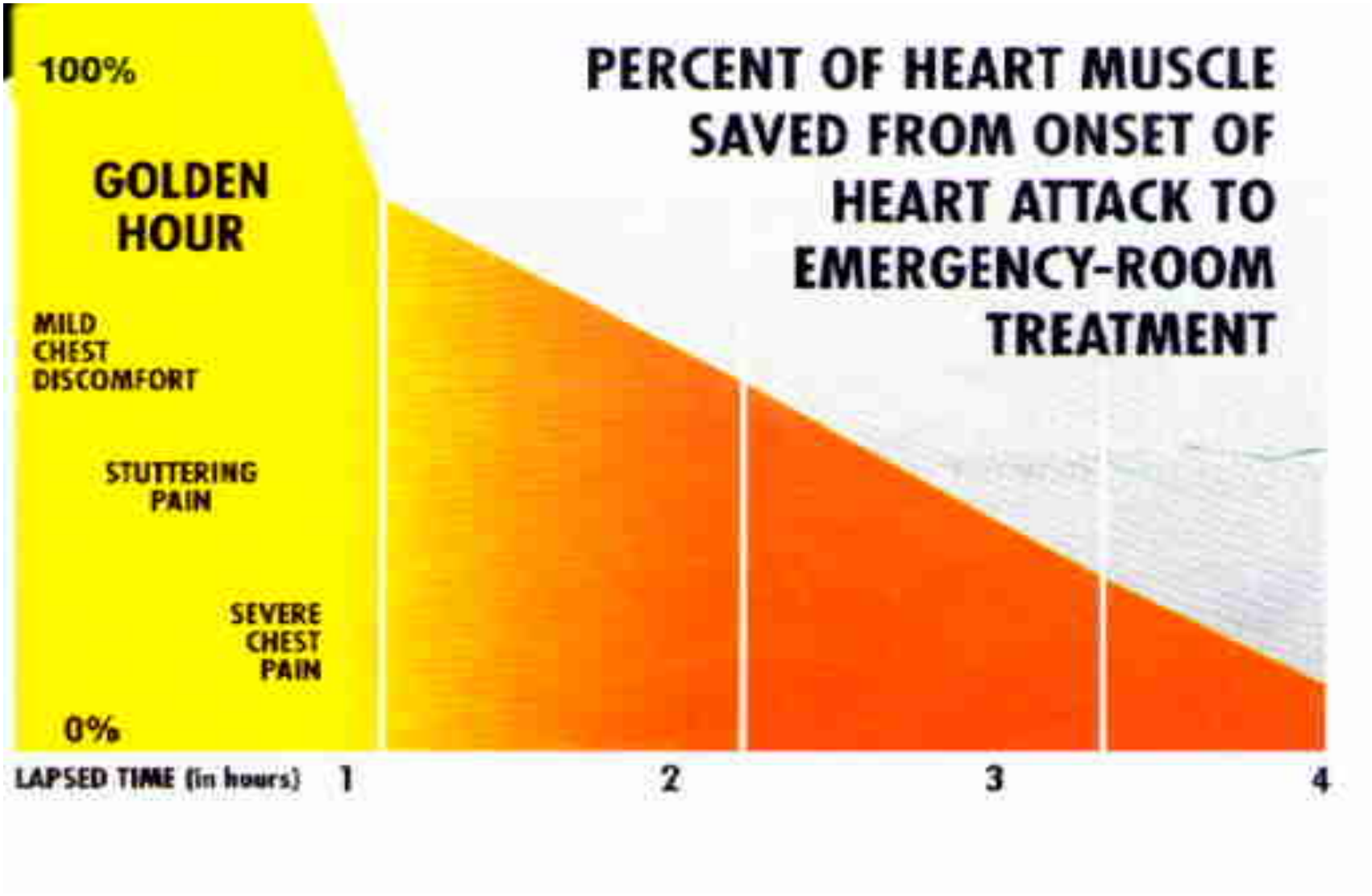
Relative contraindications

- History of chronic, sever, poorly controlled hypertension
- Systolic pressure >180 mm Hg or diastolic >110 mm Hg
- History of prior ischemic stroke >3 months previously, dementia, or known intracranial pathology not covered in absolute contraindications
- Recent (within 2–4 weeks) internal bleeding
- Noncompressible vascular punctures
- Pregnancy
- Active peptic ulcer
- Current use of anticoagulants: the higher the INR, the higher the risk of bleeding
- For streptokinase/anistreplase: prior exposure (more than 5 days previously) or prior allergic reaction to these agents

PRIMARY PCI



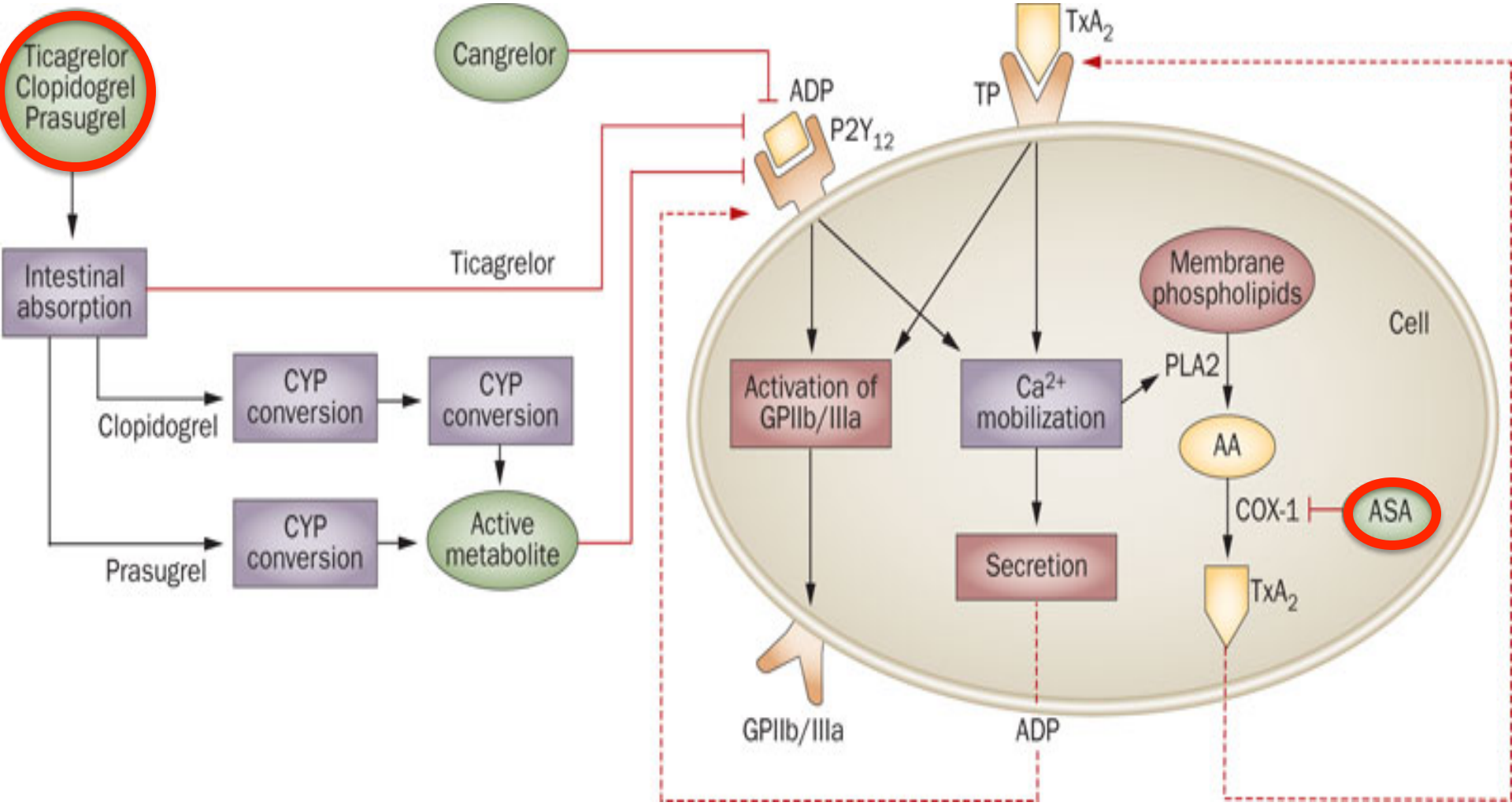
Adopted from N Eng J Med 2007


100%
GOLDEN HOUR
MILD CHEST DISCOMFORT
STUTTERING PAIN
SEVERE CHEST PAIN
0%
PERCENT OF HEART MUSCLE SAVED FROM ONSET OF HEART ATTACK TO EMERGENCY-ROOM TREATMENT
LAPSED TIME (in hours)
1
2
3
4

- STEMI Diagnosis to needle time <10min
- STEMI Diagnosis to wire crossing <90min

(Preferably <60 min)

Antiplatelet Agents



Aspirin (ASA)

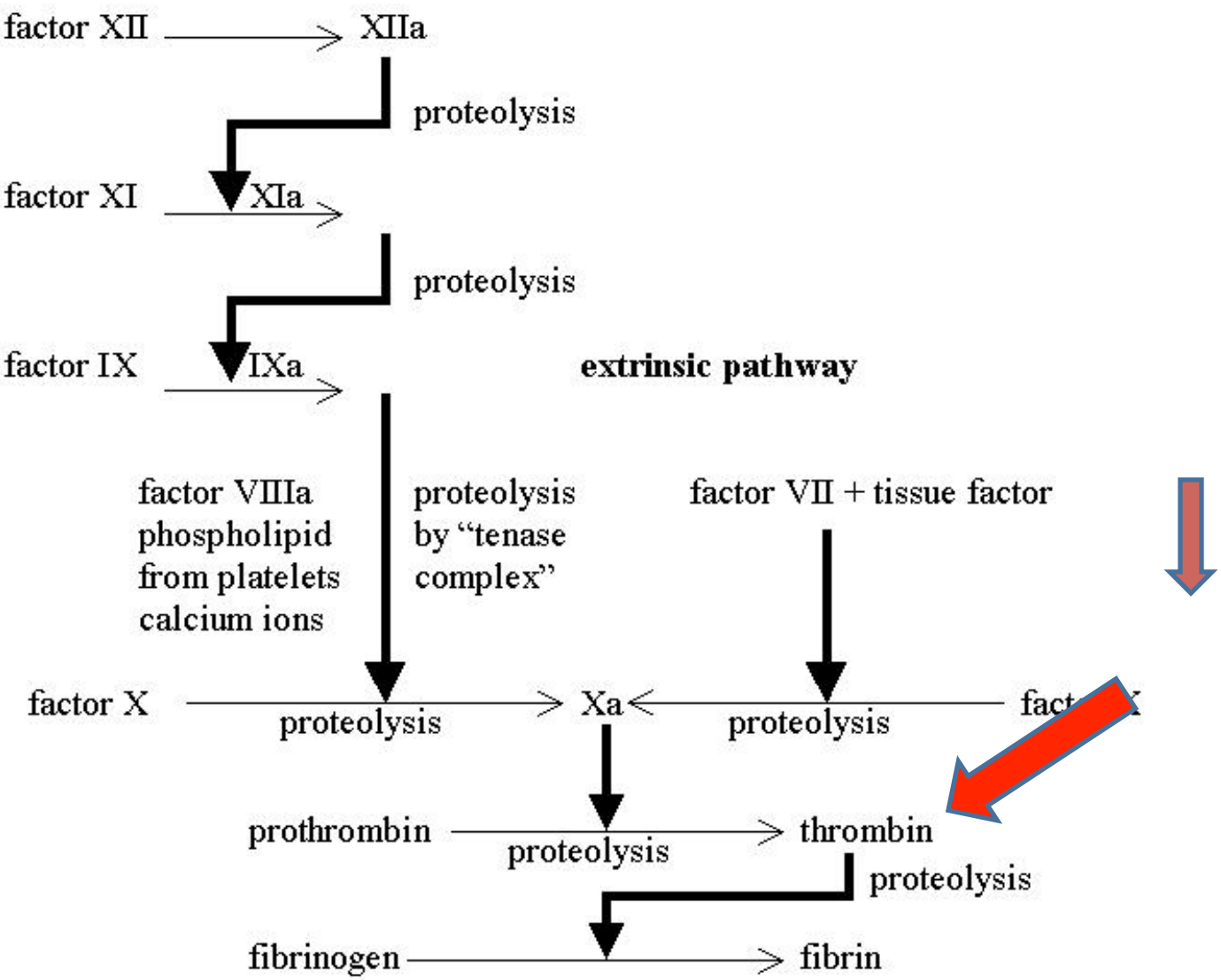
- ASA is Chewable 160 to 325 mg at presentation, then 75 to 325 mg daily.

$P2Y_{12}$ inhibitors

- More potent than ASA and is combined with ASA
- Both agents are powerful adjuncts to reperfusion therapy
- Examples:
    1. Clopidogrel
    2. Ticagrelor
    3. Prasugrel

ANTITHROMBOTICS

intrinsic pathway



Antithrombotics

- Heparin
  - Unfractionated
  - Low molecular
- Prevents further thrombosis and aids in insuring patency of the occluded artery.

Complications of MI

- **Electrical (Tachy or brady Arrhythmia)**
- **Heart failure (Pulmonary Edema)**
- **Cardiogenic Shock**
- **Mechanical complications (usually occurs late after MI …days to weeks)**

Summery

- Plaque vulnerability is affected by an inflammatory process
- Acute coronary syndromes is a spectrum and is classified according to markers of ST changes and Myocardial necrosis
- In STEMI , time to reperfusion is critical in myocardial salvage (time is muscle)