

Cardiovascular Semiology

Prof Stéphane Carlier

Department of Cardiology, UMonS (B)

Plan

- **The basics:**
 - **Anamnesis**
 - **Physical examination**
 - **Auscultation**

Cardiovascular Semiology

- Patient management:
 - **Past medical history**
 - Personal
 - Family history
 - **Risk factors predisposing to heart disease**
 - **Current medical treatments**
 - **Look for signs of disease(s)**

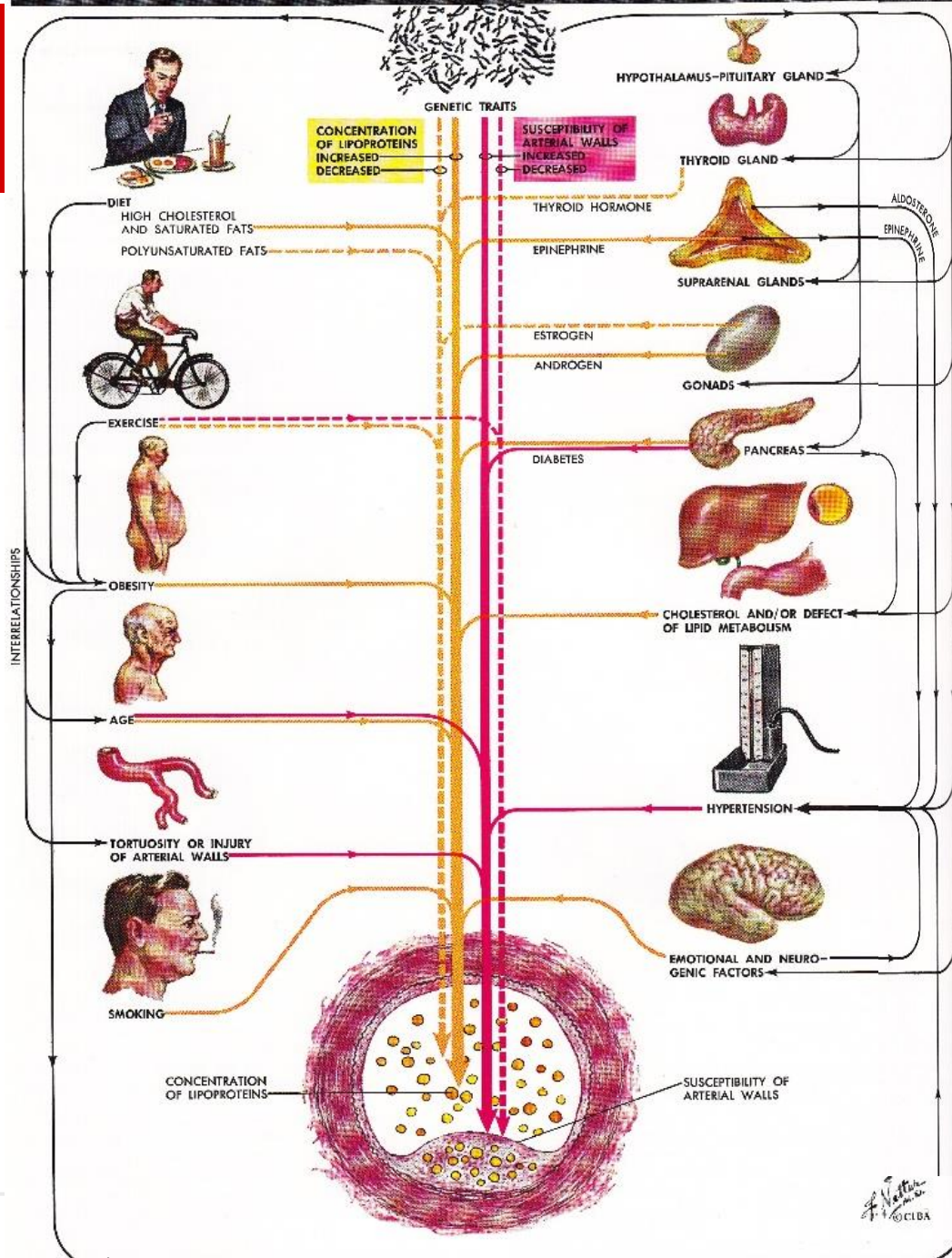
Comprehensive medical assessment based on an open-ended interview and an interrogation based on a structured questionnaire

Cardiovascular Semiology

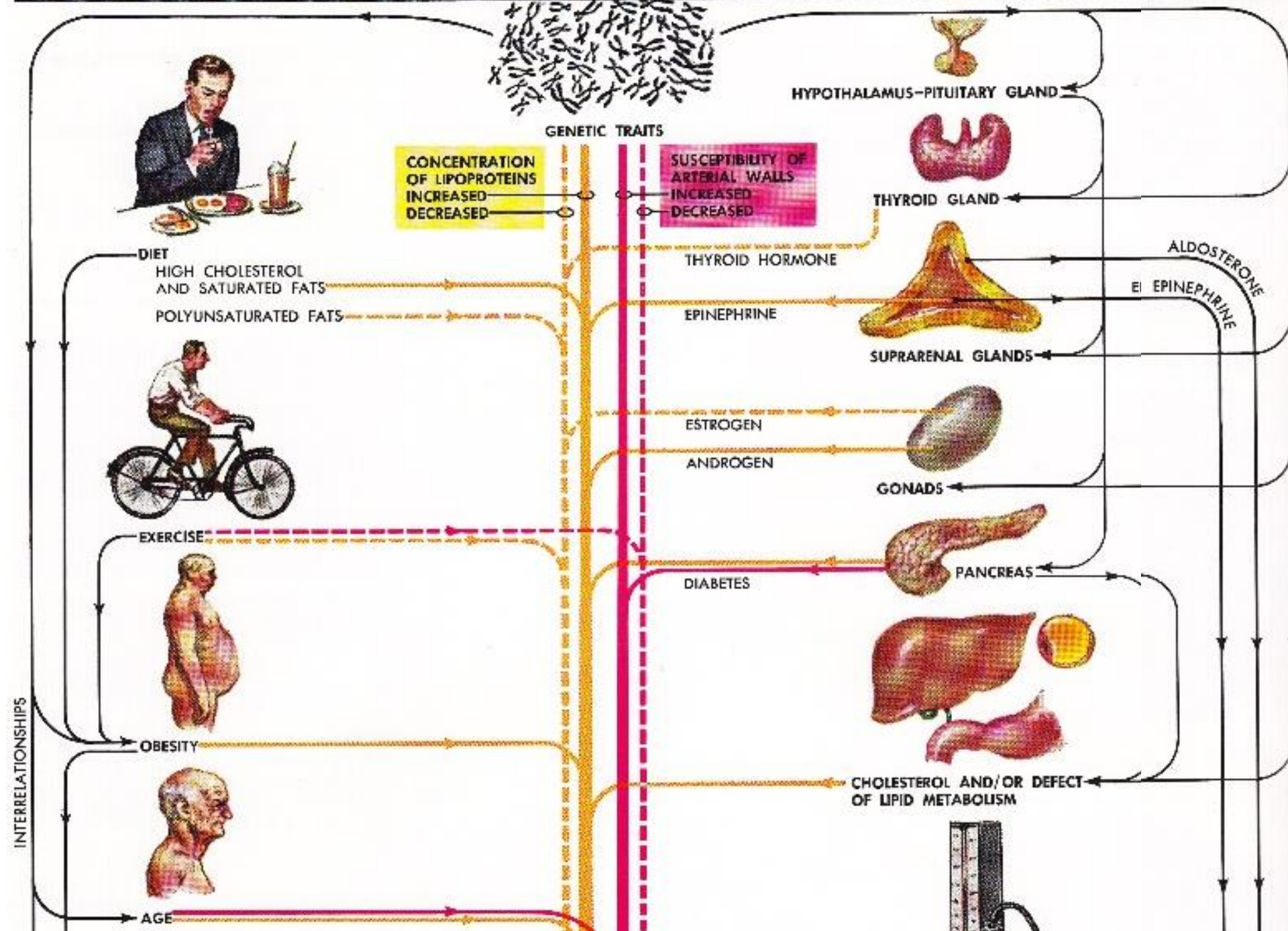
- Patient management:
 - **Medical history**
 - Personal
 - Family
 - Risk factors predisposing to heart disease
 - Current medical treatments
 - Look for signs of disease(s)
- **«The doctor who is unable to conduct a proper examination and the patient who is unable to provide the necessary information run a common risk: that of giving, or receiving, the wrong treatment.» (Paul Dudley White, 1955).**

Structured questionnaire

- **Risk factors predisposing to heart diseases**
 - Age > 55 ♂ and > 65 ♀
 - Gender: male ↑ risk
 - Arterial hypertension
 - > 140/90 mmHg
 - Length
 - Complications (ophthalmologic, renal, CVD)
 - Treatment
 - Diabetes
 - > 1,26 g/l or > 6.5% HbA1c
 - Length
 - Complications (ophthalmologic, renal, CVD)
 - Treatment



INTERRELATED FACTORS REPUTEDLY CONCERNED IN ETIOLOGY OF ATHEROSCLEROSIS



Anamnesis or Medical History

- greek *anamnêsis*: *recall the memories*

In medicine, this is all the information a patient provides about his past and the history of his illness.

- **Chest discomfort and angina**
- **Dyspnea**
- **Cough and hemoptysis**
- **Palpitations**
- **Syncope**
- **Fatigue**
- **Edema**
- **Cyanosis**
- **Intermittent claudication, limb pain**

Chest Pain

- 50% of chest pain during consultation suggests a CVD
- **Crucial to recognise them**
 - Because a physical examination will often provide no additional information
 - Failure to do so can have serious consequences
- **Cardiovascular chest pain**
 - Angina pectoris or myocardial infarction
 - Pericarditis
 - Pulmonary embolism
 - Aortic dissection
 - Arrhythmia

Chest Pain

- Non cardiovascular

- Osteoarticular

- **Tietze syndrome:** acute chest pain in the 2nd or 3rd chondro-costal or chondro-sternal joints, aggravated by movements. Often of unknown cause, sometimes secondary to intercostal haematoma or inflammation of the cartilage at the junction of the sternum and one or more ribs.

- Treatment: NSAIDs

- **Cervicobrachial pain** < cervical pathology or scapulohumeral periarthritits

- **Intercostal pain**

- Pneumonia, neoplasia,...

- ↑ breathing, pyrexia



Inspection of the costosternal joint for swelling indicative of Tietze's syndrome. (From Waldman SD: Physical Diagnosis of Pain: An Atlas of Signs and Symptoms. Philadelphia, Saunders, 2006, p 209.)

Chest Pain

- Non cardiovascular
 - Digestive abnormalities
 - Esophageal reflux
 - Hiatal hernia
 - Gastric ulcer
 - Pancreatitis
 - Cholecystitis
 - Hepatomegaly < right heart failure
 - « Nervous » pain
 - Variable location and temporality, not related to exercise,
 - « Needle stroke », stabbing,...
 - Laterothoracic, dysaesthesia
 - Erratic in anxious patients

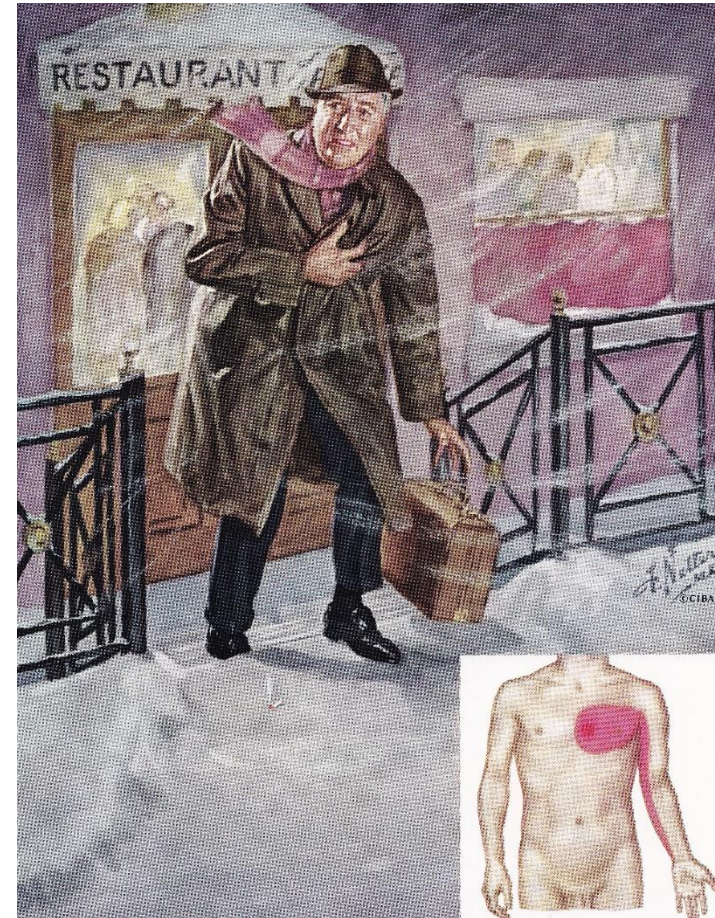
Angina Pectoris

- **Heberden W**

Medical Transactions 2, 59-67 (1772) London: Royal College of Physicians.

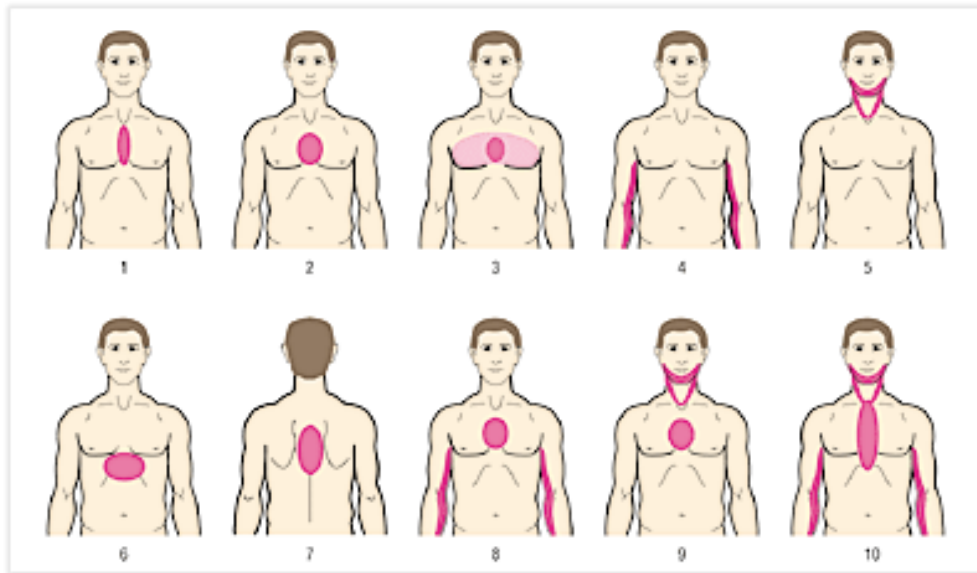


- Constrictive pain
- Precipitated by exertion
- Radiated to arms / shoulders
- Less than 15 minutes, stops with rest
- Decreased by nitrates

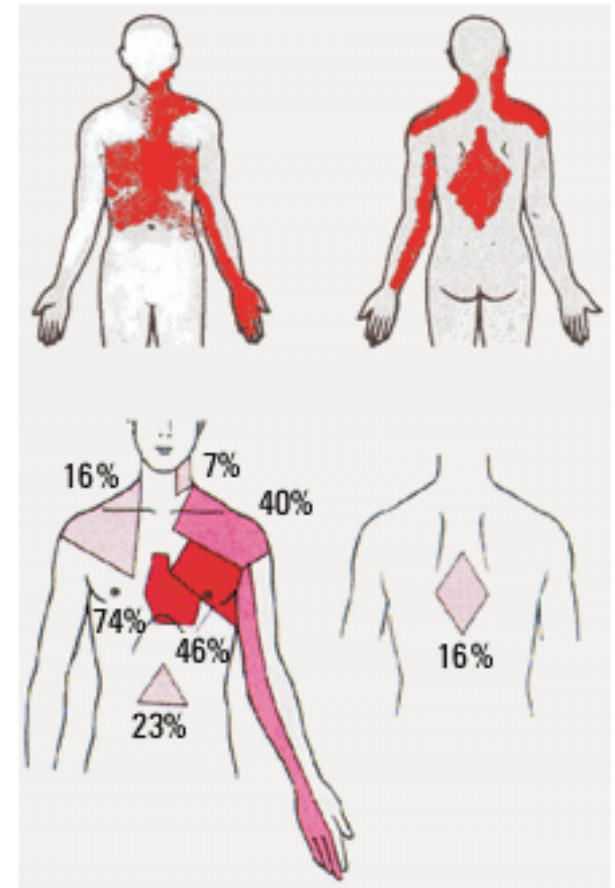


Angina Pectoris

- Highly variable

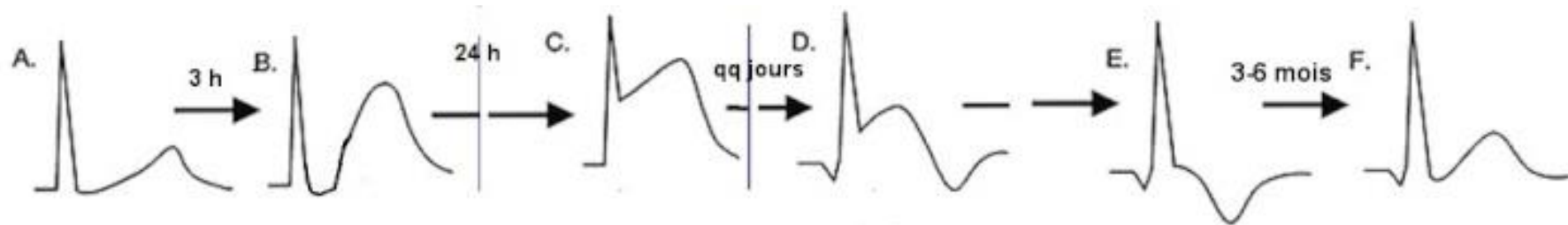
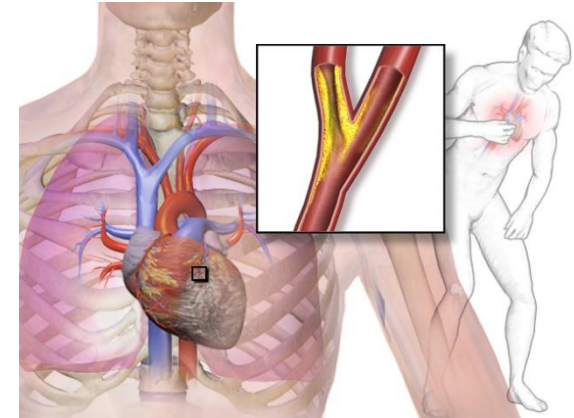


- Typical: radiated shoulder / neck
 - Epigastric
- To be evaluated
 - Temporal evolution
 - Precipitating factors



Angina Pectoris

- Related to **myocardial ischemia** simultaneous **changes of ECG**
- Associated with coronary lesion: first description by Jenner in 1786



Atypical Chest Pain

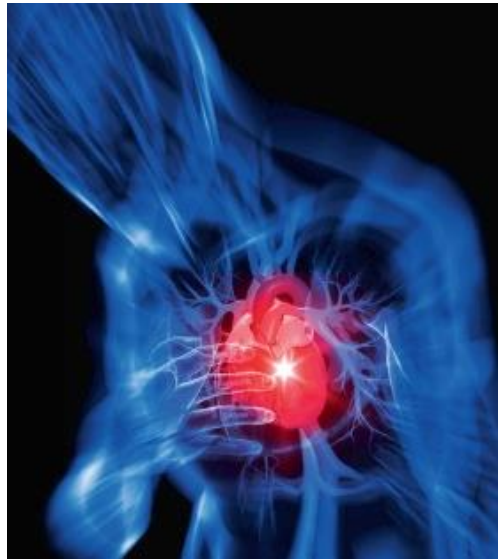
- Epigastric pain
- Dyspnea
- Palpitations
- Lower diagnostic value, but becomes typical once linked with previous coronary stenosis

Stable Angina Pectoris

- Resulting from insufficient coronary blood flow in relation to myocardial consumption
- During exercise, for a given ischaemic threshold:
 - Walking
 - Climbing stairs
- Favoured by:
 - Cold
 - Walking against the wind or uphill
 - Post-prandial
 - Stress, emotion
- Stops with effort, otherwise MYOCARDIAL INFARCTION

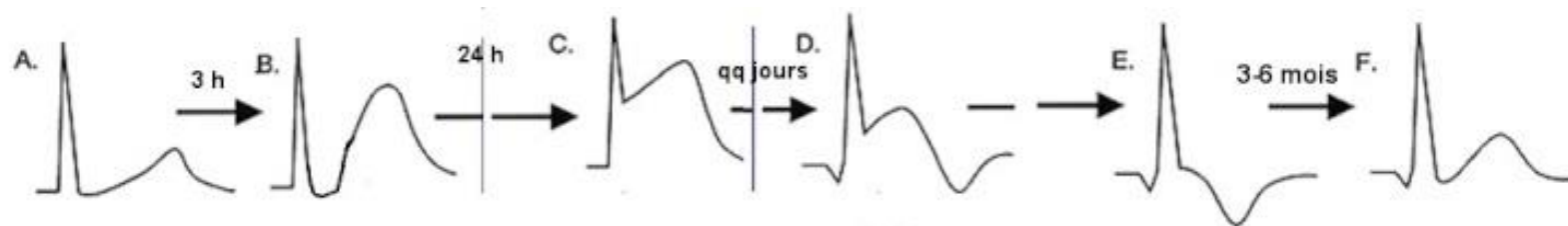
Canadian Cardiovascular Society (CCS)

- CCS class I: angina for unusual exertion
- CCS class II: angina for usual exertion
- CCS class III: angina for minimal exertion
- CCS class IV: angina at rest



Acute Coronary Syndrome

- New onset angina
- Aggravating angina
- Angina at rest / myocardial infarction
 - Very important chest discomfort
 - Irradiating++
 - More than 20 minutes, no effect of nitrates
 - Nausea,...

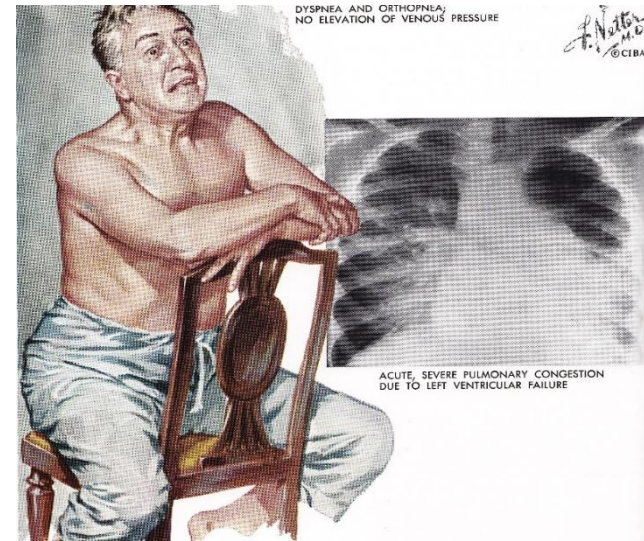


Chest Pain

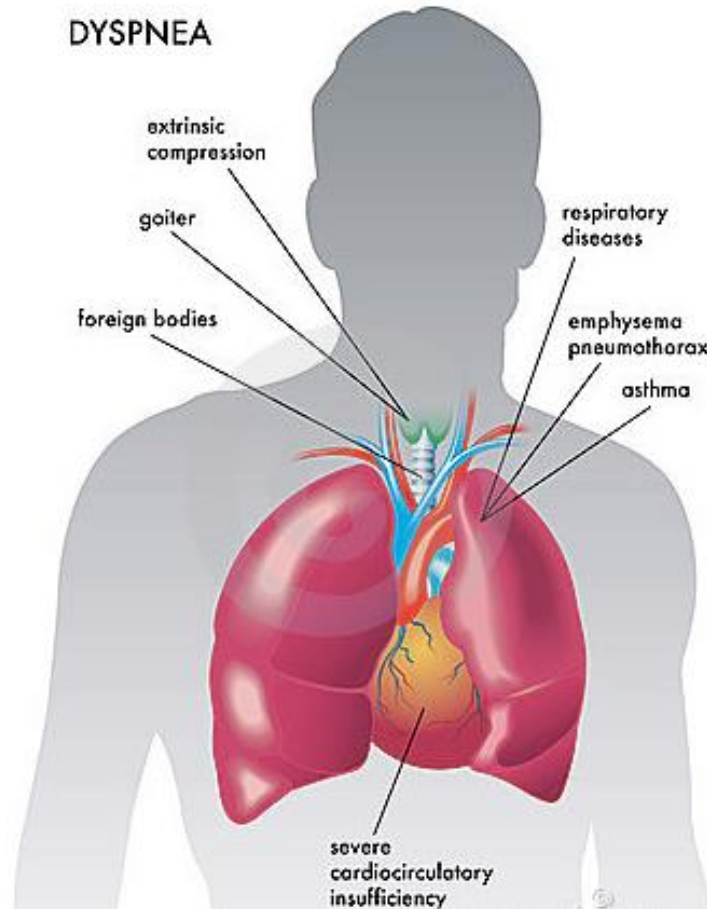
- 50% of chest pain during consultation suggests a CVD
- **Crucial to recognise them**
 - Because a physical examination will often provide no additional information
 - Failure to do so can have serious consequences
- **Cardiovascular chest pain**
 - Angina pectoris or myocardial infarction
 - Pericarditis
 - Pulmonary embolism
 - Aortic dissection
 - Arrhythmia

Dyspnea

- With exertion
- In recumbency (orthopnea)
- Standing (platypnea)
- **Paxoxysmal nocturnal dyspnea**
 - Sufficient to compel patient to sit upright or stand
- Objectively:
 - **Tachypnea**
 - **Hyperpnea**
 - **Hyperventilation**
 - **Cheyne-Stokes:** in heart failure
 - **Kussmaul et Kien:** in metabolic acidosis (Diabetes)



Dyspnea : mixed mechanisms



- Alveolar edema (**capillary pressure >18 mmHg**)
- Decreased pulmonary compliance and weakness of respiratory muscles

New York Heart Association Classification

- **NYHA class I:** for strenuous, abnormal exercise
 - no symptoms for daily life activities
- **NYHA class II:** dyspnea for moderate efforts (walking fast, uphill, stairs >2 floors)
 - *moderately affected daily life*
- **NYHA class III:** dyspnea for mild efforts (walking, climbing stairs)
 - *Important decrease in normal life*
- **NYHA classe IV:** dyspnea at rest

NYHA Classification

- **Evaluation of severity** of heart failure;
- Homogenous groups of patients;
- Effect of therapies / reimbursement



NYHA II



NYHA III



NYHA IV

Functional Classifications

- Chest discomfort and angina
- Dyspnea

TABLE 1. *New York Heart Association Functional Classification*¹

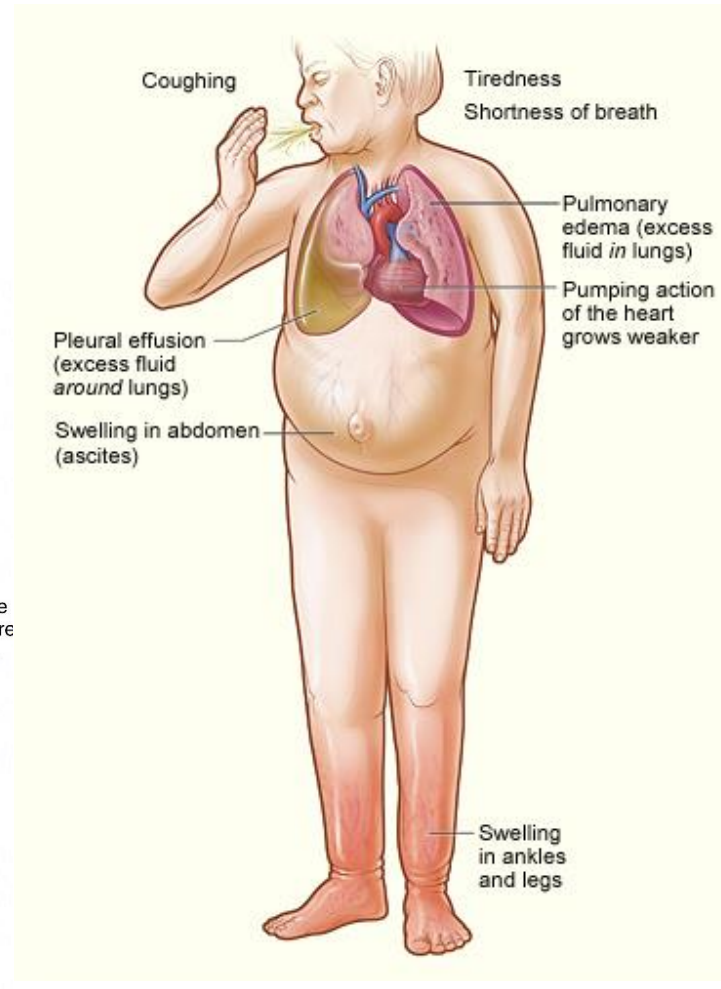
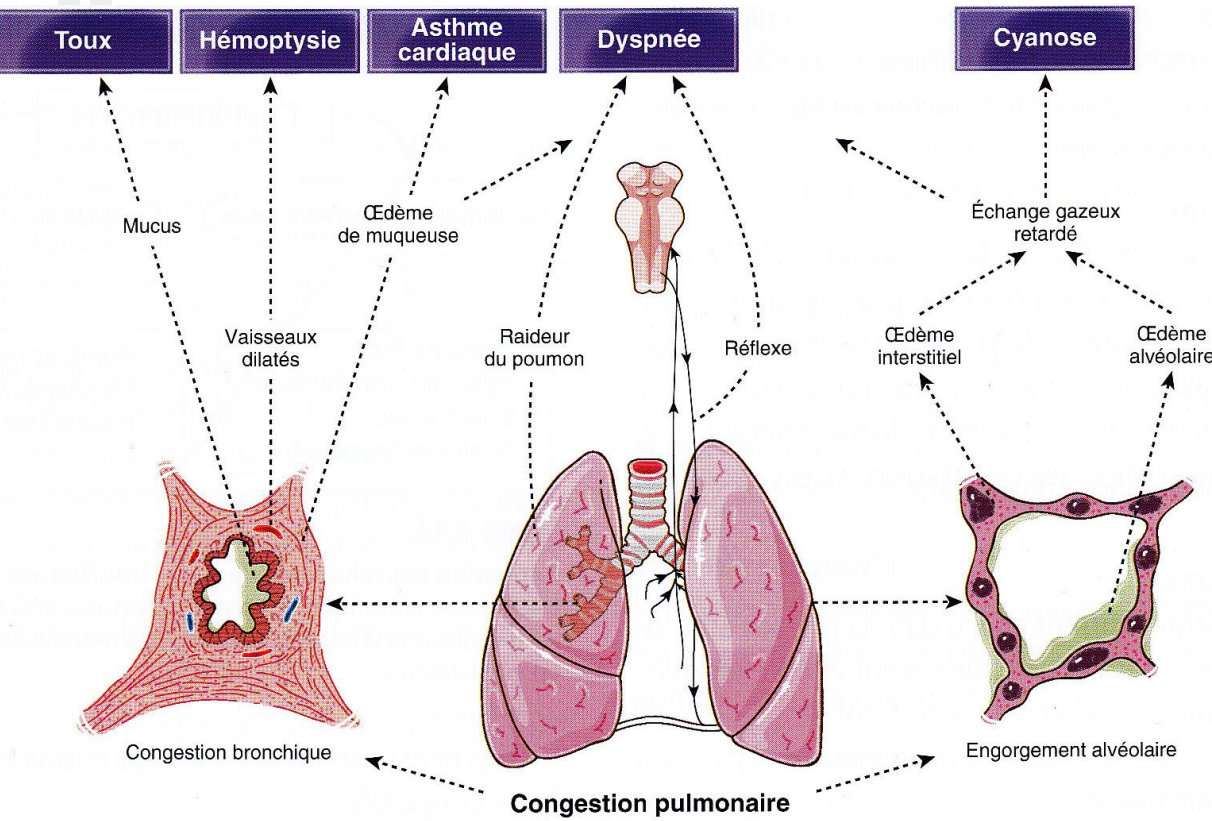
Class I	Patients with cardiac disease but without resulting limitations of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea, or anginal pain.
Class II	Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea, or anginal pain.
Class III	Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary physical activity causes fatigue, palpitation, dyspnea, or anginal pain.
Class IV	Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of cardiac insufficiency or of the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort is increased.

TABLE 2. *Canadian Cardiovascular Society Functional Classification*²

Class I	Ordinary physical activity does not cause angina, such as walking and climbing stairs. Angina with strenuous or rapid or prolonged exertion at work or recreation.
Class II	Slight limitation of ordinary activity. Walking or climbing stairs rapidly, walking uphill, walking or stair climbing after meals, or in cold, or in wind, or under emotional stress, or only during the few hours after awakening. Walking more than 2 blocks on the level and climbing more than one flight of ordinary stairs at a normal pace and in normal conditions.
Class III	Marked limitation of ordinary physical activity. Walking one to two blocks on the level and climbing one flight of stairs in normal conditions and at normal pace.
Class IV	Inability to carry on any physical activity without discomfort — anginal syndrome <i>may</i> be present at rest.

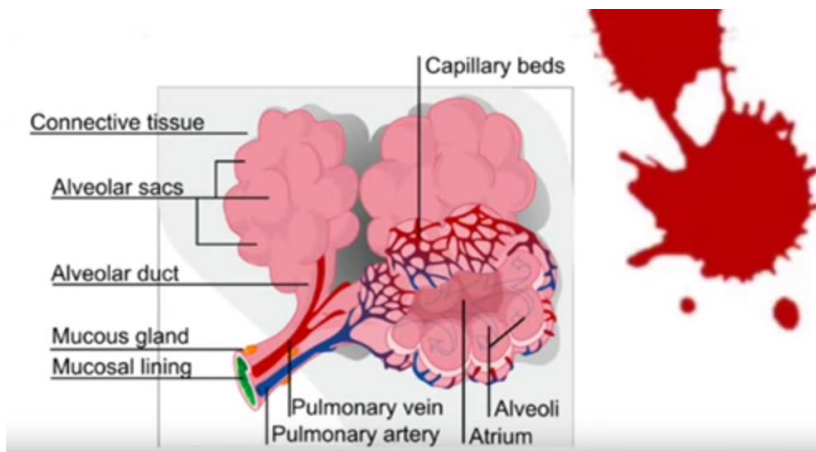
Cough

- During exercise, secondary to pulmonary hypertension
 - Cardiac asthma
 - Pulmonary stasis - infection



L'anamnèse cardiovasculaire

- **Hemoptysis:** coughing up red blood
 - Pulmonary hypertension
 - Pulmonary infarction
 - Pulmonary embolism



Palpitations

- Missing beat, skips, pounding

CHIU AMBROISE PARE CONS CARDIO	Nom :	Sexe : M	FC : 87	3/12/2014 12:01:43
	Prénom :	Age : 81	PA : 0/ 0	Intervalles :
	Numéro Identité : 002038419	Taille(cm) :	Axes :	RR 680 ms
	Date de naissance : 30/08/1933	Poids(Kg) :	P 78,9 °	P 114 ms
			QRS 54,7 °	PQ 168 ms
			T 75,2 °	QRS 76 ms
				QT 376 ms
				QTc 452 ms



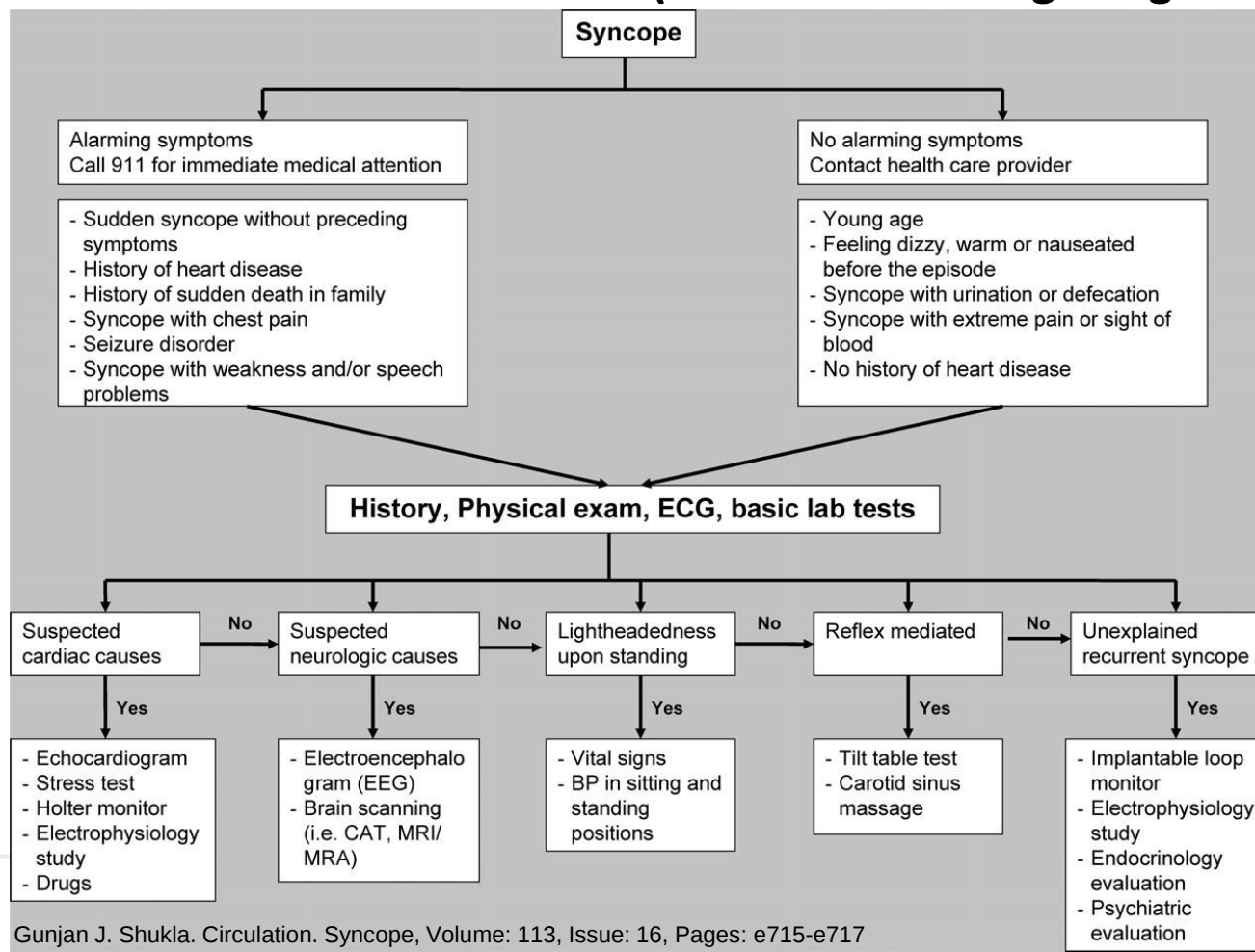
10 mm/mv 25 mm/sec



Syncope

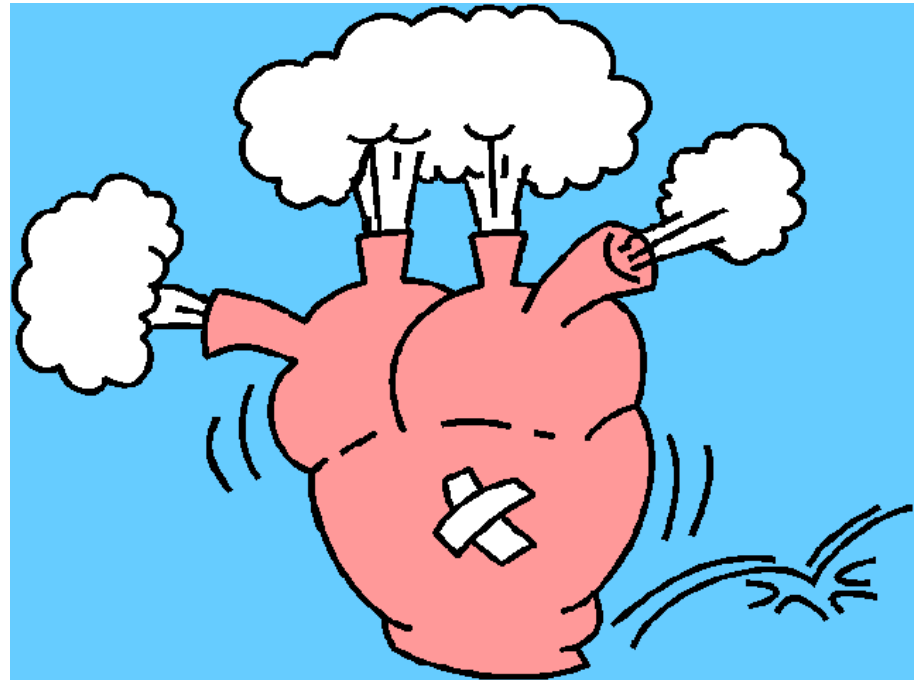
- **SYNCOPE:**

- Sudden loss of consciousness, rapid restoration, recovery
- Insufficient cerebral blood flow (*Adams-Stokes*: high degree AV block)



Anamnesis or Medical History

- Chest discomfort and angina
- Dyspnea
- Cough and hemoptysis
- Palpitations
- Syncope
- **Fatigue**



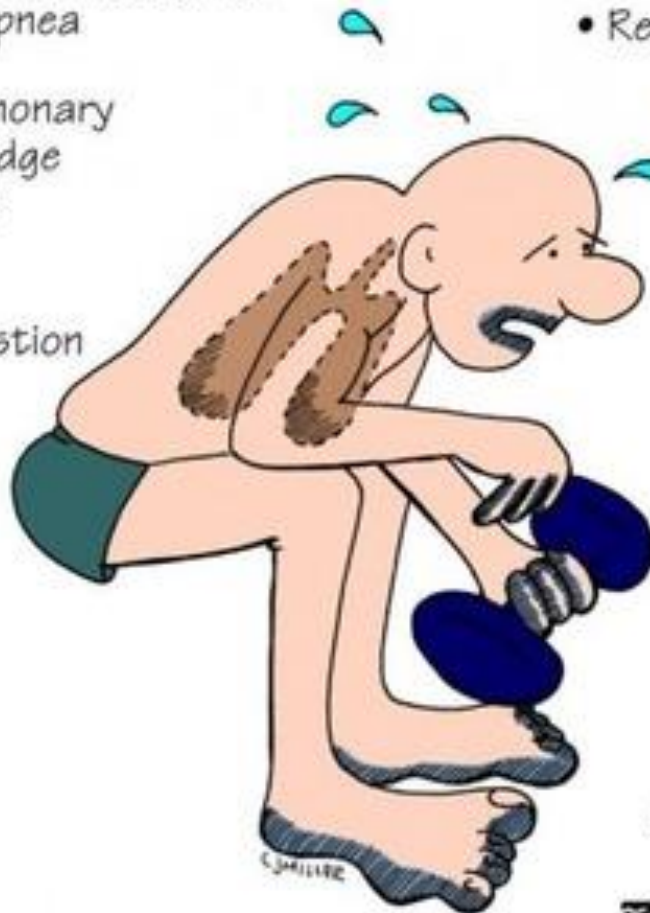
Physical Examination

- **General**
- **Arterial**
- **Venous**
- **Edema**

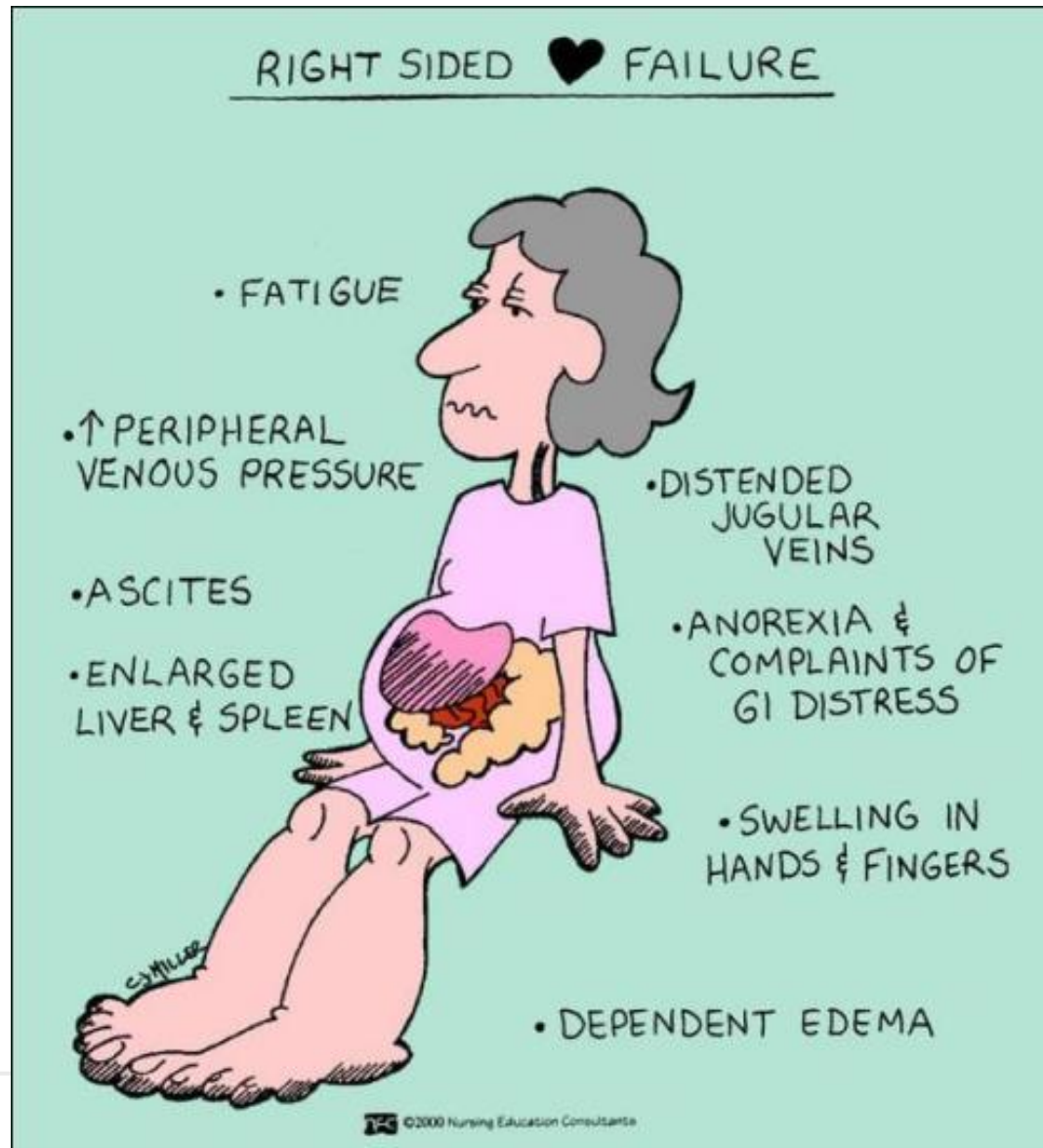
Physical Examination

LEFT SIDED ♥ FAILURE

- Paroxysmal Nocturnal Dyspnea
- Elevated Pulmonary Capillary Wedge Pressure
- Pulmonary Congestion
 - Cough
 - Crackles
 - Wheezes
 - Blood-Tinged Sputum
 - Tachypnea
- Restlessness
- Confusion
- Orthopnea
- Tachycardia
- Exertional Dyspnea
- Fatigue
- Cyanosis

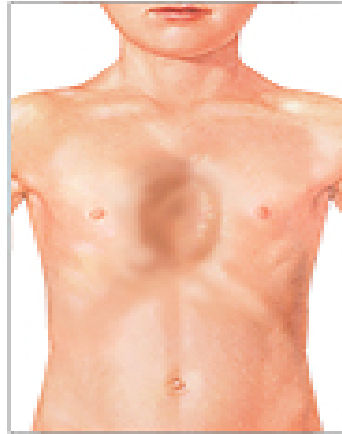


Physical Examination



General physical examination

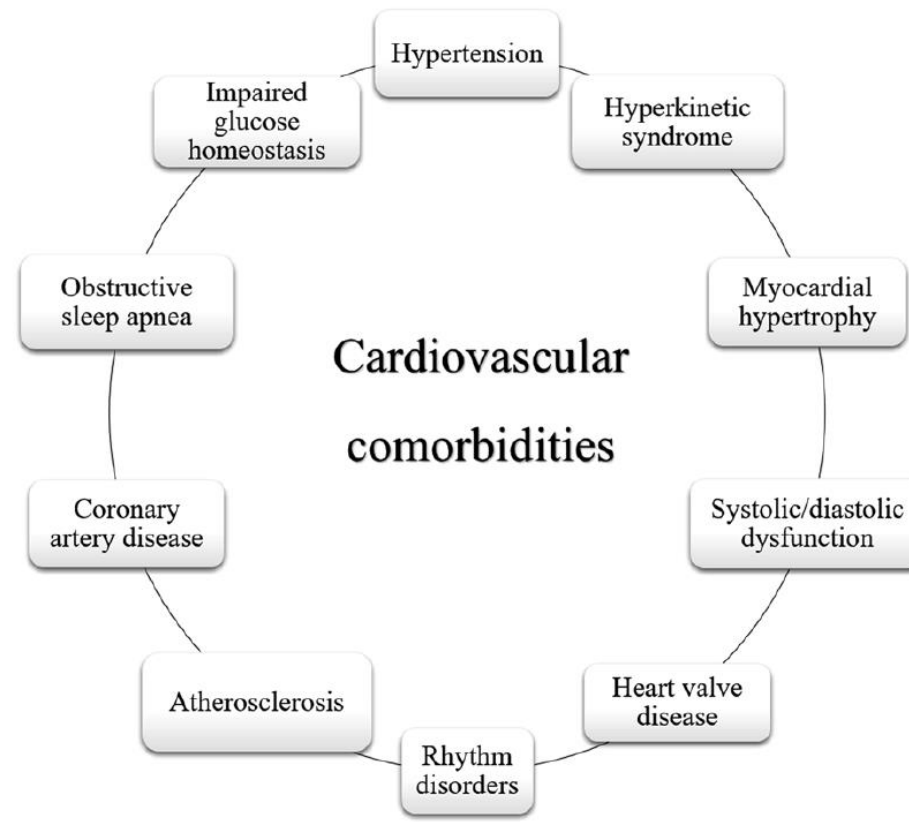
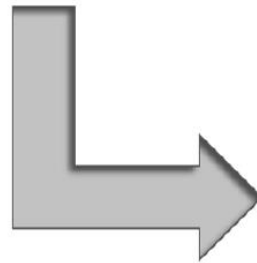
1- Morphotype



General physical examination

1- Morphotype

- GH/IGF-I excess
- Disease duration
- Age
- Coexistence of other associated risk factors



Body mass index

Body Mass Index (BMI): Weight (Kg) / Height² (m²)

IMC	État
de 18,5 à 25	Poids normal
de 25 à 30	Surpoids
de 30 à 35	Obésité modérée
de 35 à 40	Obésité sévère
> 40	Obésité morbide



- ✓ **Waist circumference** (at iliac crest)
- ✓ **Waist-to-hip ratio**

General physical examination

- *Anemia - pallor*



General physical examination

■ Cyanosis



- ✓ **Central:** significant right-to-left shunting in heart or lungs
- ✓ **Peripheral:** reduced blood flow

✓ Hypoxemia

✓ « Blue » when more than 5 g/dL of deoxygenated hemoglobin



General physical examination



Raynaud



Acrocyanosis



Acute Ischemia

General physical examination

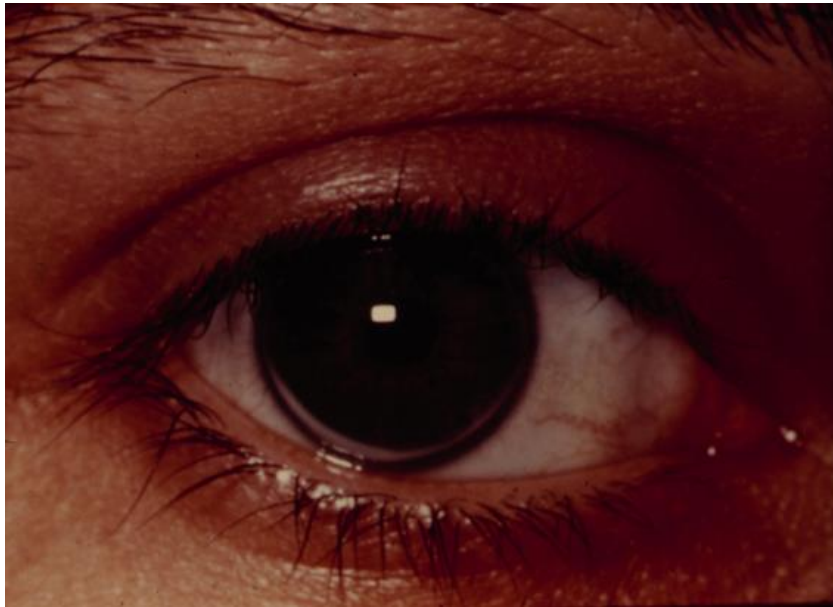


Tissular Hypoperfusion



General physical examination

- *Lipid disorders*



Corneal arch



Xanthelasma

General physical examination

- **Lipid disorders**

Xanthoma

→ **Familial
hypercholesterolemia**



General physical examination

- *Clubbing*



General physical examination

■ Endocarditis

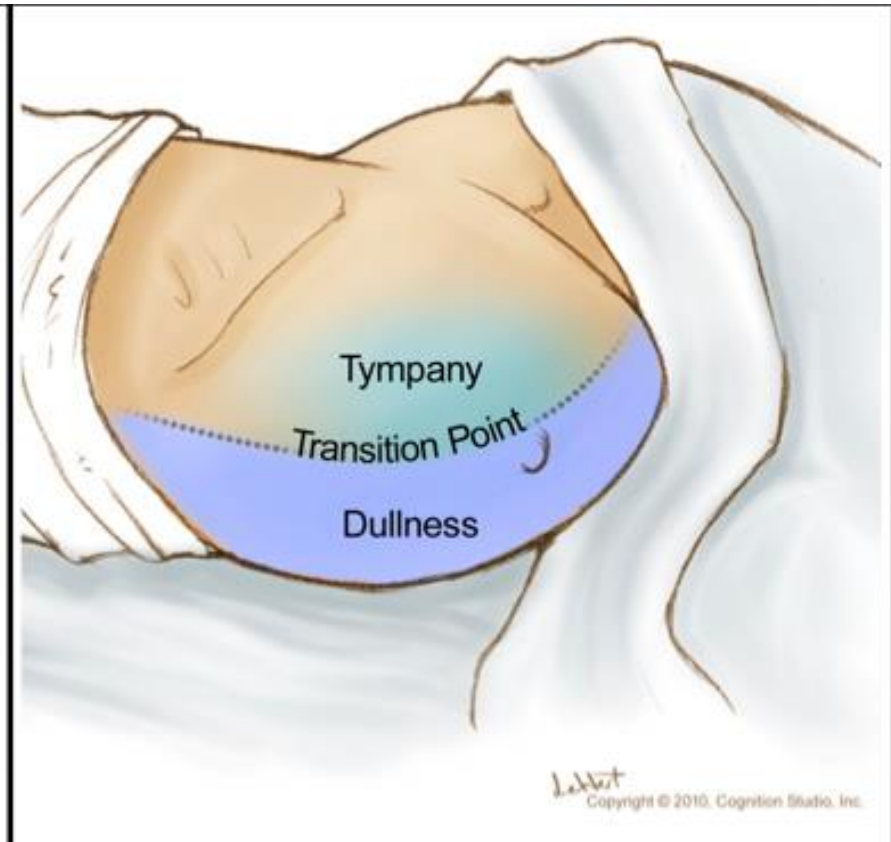
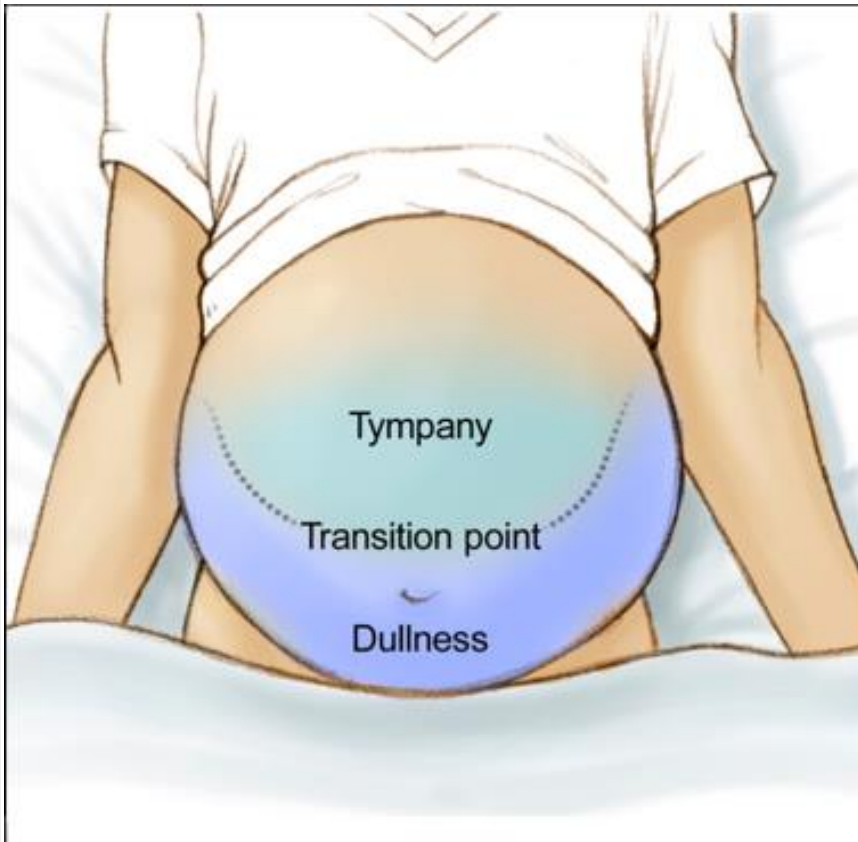
Petechia



JANEWAY's erythema



General physical examination

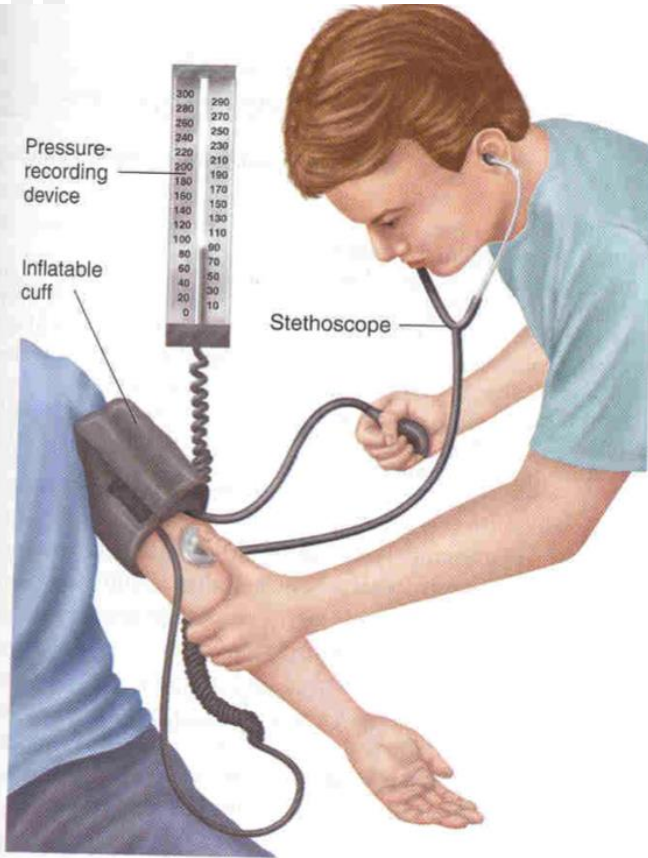


Physical Examination

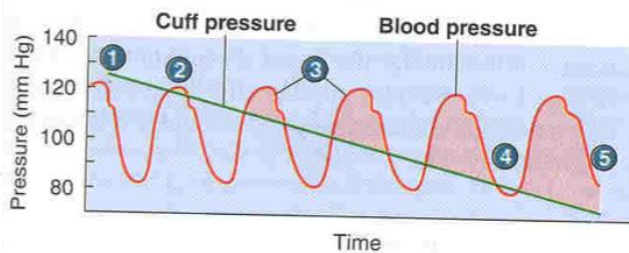
- General
- **Arterial**
- Venous
- Edema



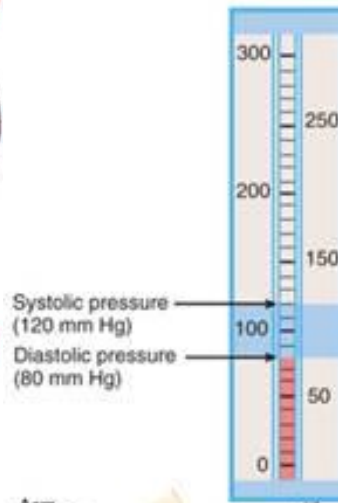
Measurement of Blood Pressure



(a)



When blood pressure is 120/80:



Blood flows through the vessel in smooth, laminar fashion.

No sound is heard.

Degree to which brachial artery is open during:

Systole	Diastole	
Blocked	Blocked	Blocked
Blocked or partially open	Blocked or partially open	Blocked or partially open
Open	Open	Open

Arterial examination

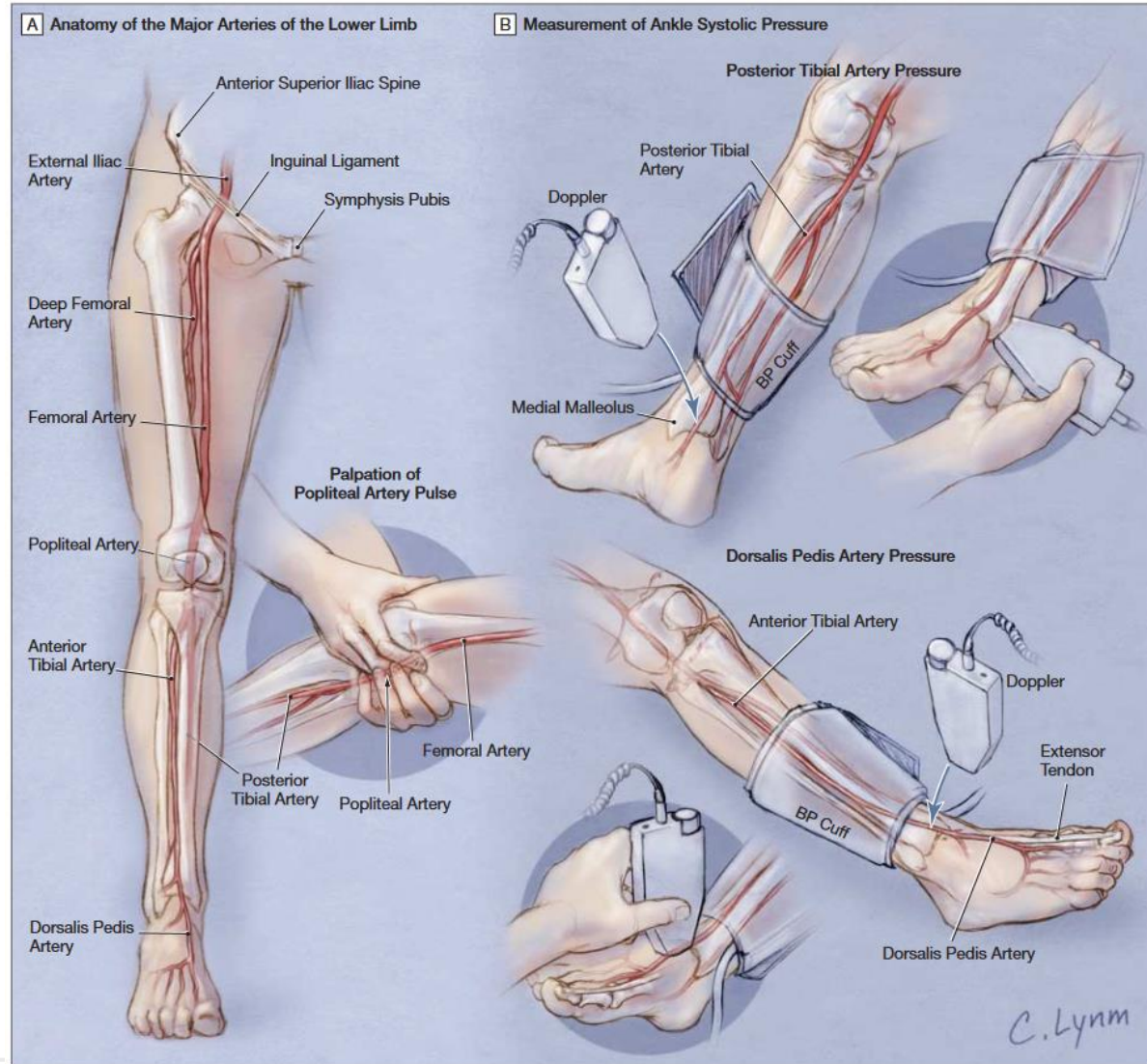
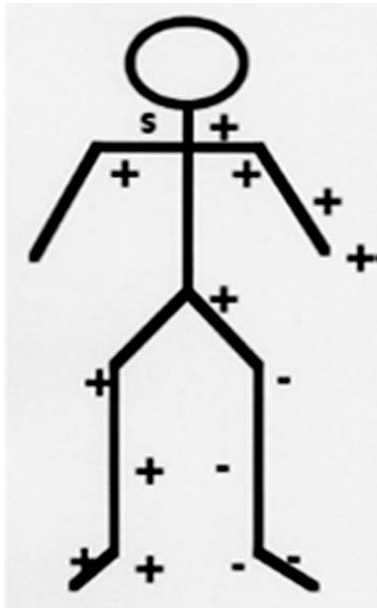


***Palpation
AND
Auscultation***



Arterial examination: Ankle Brachial Index

Normal ABI > 1



A, Normal arterial anatomy of the right lower limb in anterior view and palpation of the popliteal pulse with the examiner's hands tucked into the popliteal fossa (inset, posteromedial view). B, To obtain ankle systolic pressure for calculating the ABI using the posterior tibial artery (B, top) or the dorsalis pedis artery (B, bottom), the blood pressure cuff is placed above the pulse. The Doppler probe is positioned over the area of the arterial pulse.

Arterial examination

Ulceration



« Blue toe »

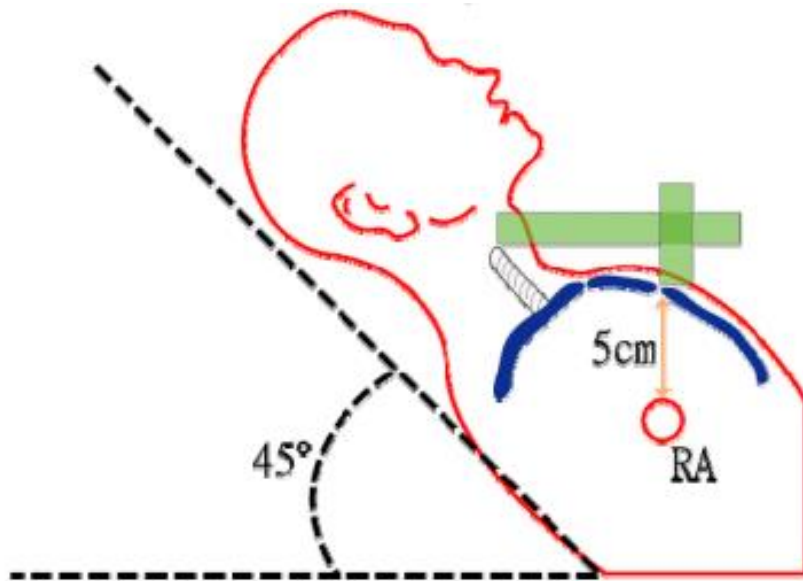


Physical Examination

- General
- Arterial
- **Venous**
- Edema

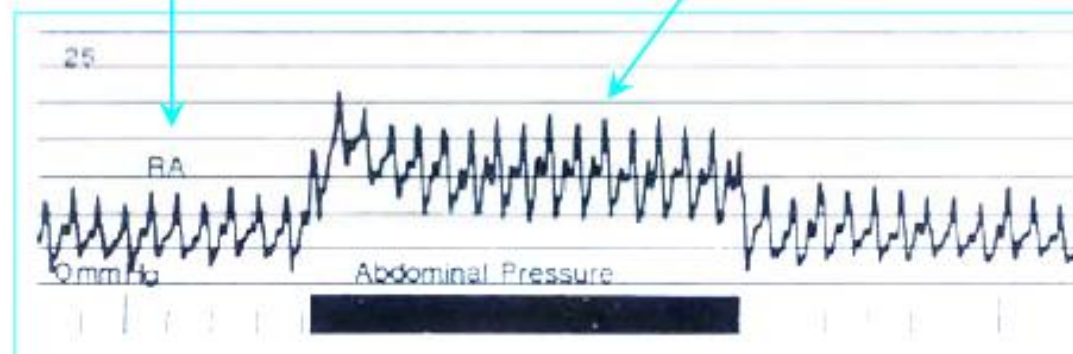
Venous examination

✓ Jugular Venous Pressure

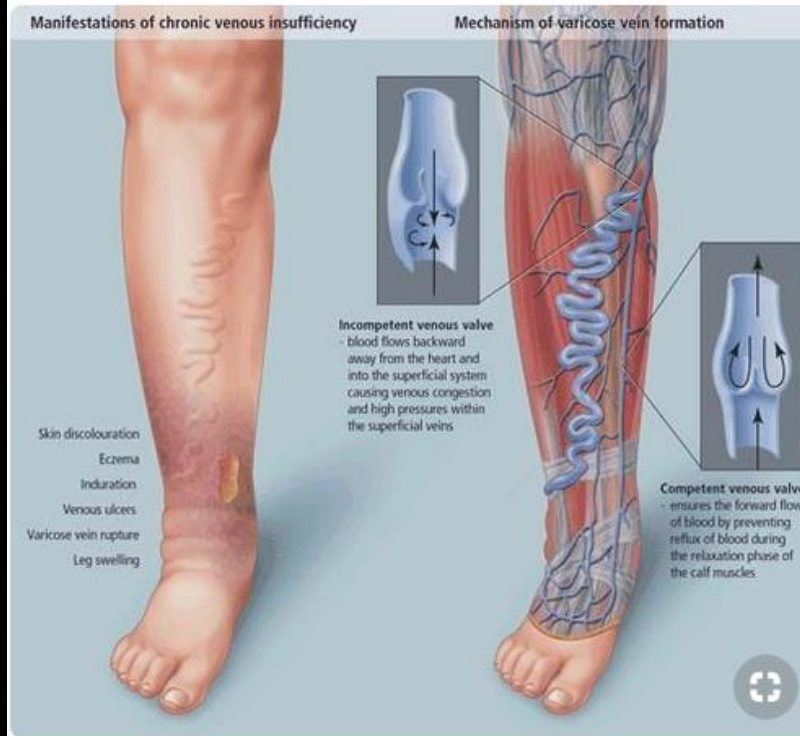


Venous examination

✓ ***Abdominojugular reflex***



Venous examination



Venous examination

- *Superficial phlebitis*

A relatively frequent complication of a varicose vein. It is suggested by the appearance of an inflammatory placard, often very painful, located on an indurated varicose vein.



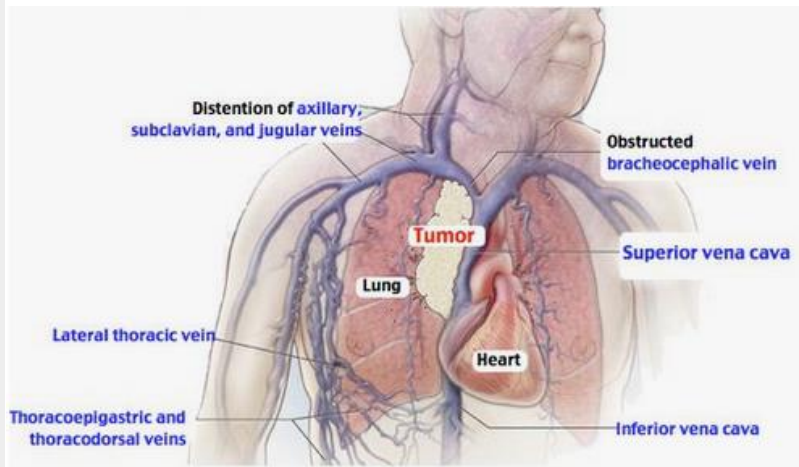
Venous examination

✓ Portal hypertension



Venous examination

✓ *Superior vena cava syndrome*



Source: <http://www.respir.com/doc/abonne/base/CirculationCollaterale.asp>

Physical Examination

- General
- Arterial
- Venous
- **Edema**

Edema

Edema = increase in volume, localised or diffuse, uni or bilateral.

Abnormality of the extracellular sector

< retention of water and sodium in the interstitial spaces

Attenuation/ disappearance of osteo-muscular and tendinous relief

Palpation: hard, renitent or soft sensation

Bucket sign = persistence of depression after digital pressure

Edema secondary to :

an increase in hydrostatic pressure

a decrease in oncotic pressure

an increase in membrane permeability

impaired lymphatic drainage.

Cardiac edema

✓ *In heart failure*

1. ***Bilateral***
2. ***White***
3. ***Soft***
4. ***Declining***
5. ***Painless***
6. ***Pitting***



The pathophysiological mechanism is an increase in hydrostatic pressure

Venous edema

Venous causes of edema include :

Deep vein thrombosis (acute situation)

Chronic venous insufficiency, primary or post-thrombotic

More rarely, we may find :

acquired or congenital arteriovenous fistulas (Klippel-Trenenunay syndrome)
venous angiodysplasia.



Venous edema

- *Deep venous thrombosis*

- *Unilateral*
- *Red*
- *Warm*
- *Painful*
- *Firm*

- Homans' sign +:

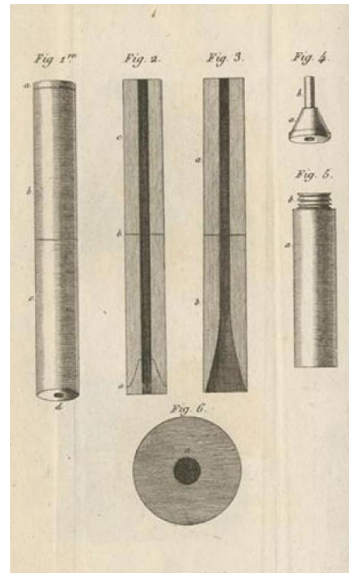


Pain pushing on foot < extension

Cardiac auscultation

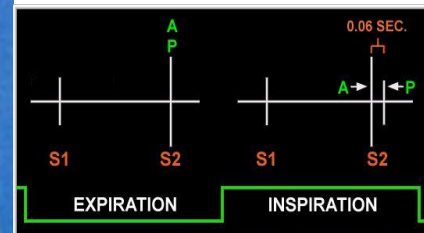
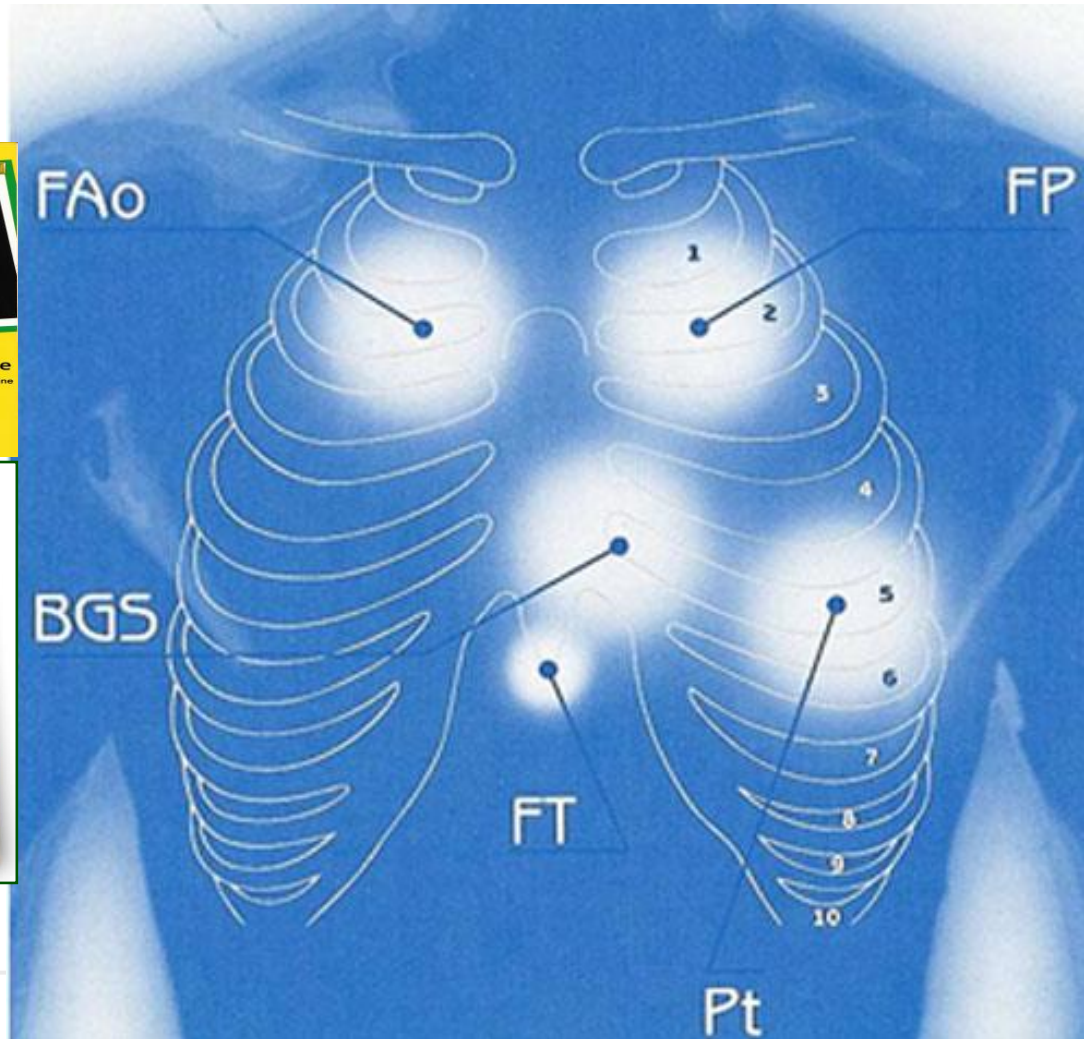
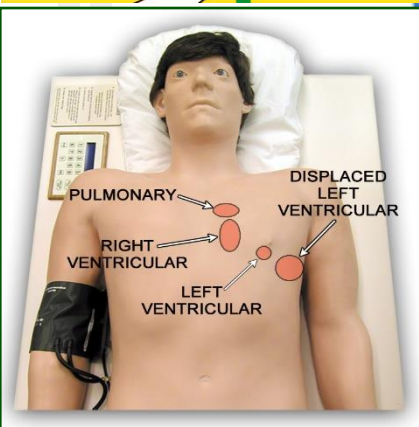
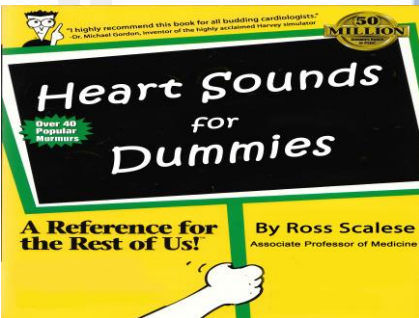
✓ *First description*

René Laënnec 1816



Cardiac auscultation

✓ Heart sounds



- S2 splitting
- $A2 > P2$

The End of Auscultation?

THE WALL STREET JOURNAL.

Home World U.S. Politics Economy Business Tech Markets **Opinion** Arts Life

A Stethoscope for the Next 200 Years

The ability to see 'alien' DNA and RNA in the blood can detect cancers very early.

By ERIC TOPOL And STEPHEN R. QUAKE

Jan. 2, 2015 6:55 p.m. ET

79 COMMENTS

When [Rene Laennec invented the stethoscope in 1816](#) he could not have foreseen its immense value for the medical profession. Ironically, his device was misnamed—it is actually a “stethophone” that doesn’t see into, or scope, anything, but simply allows the listener to hear sounds from within the body. But now, fueled by the genomics revolution, we are beginning to reap the benefits of a new stethoscope—one that sees inside the body at the molecular level.

Recent research advances by scientists around the world have shown that it’s possible to detect and sequence “alien” DNA in the blood that is distinct from an individual’s normal genome. This includes DNA from a virus or bacterium that has caused infection, tumor DNA from an undetected cancer, DNA from the fetus found in a pregnant mother’s blood sample, and even another person’s DNA due to the body’s rejection of an organ tr:

Handheld Ultrasound—The New Stethoscope?



Dr Topol: Haven't used a stethoscope in 2 years

The future of mHealth is bright, according to West Wireless Health Institute vice chairman Eric Topol, who spoke this week at the opening keynote of the 2011 mHealth Summit. "This is a most momentous moment in medicine," he told the gathered audience. Topol's keynote discussion included current wireless medical products as well as future speculation that will leverage genomics with biosensor data to revolutionize personal health.

Topol's keynote, titled "The Creative Destruction of Medicine" after his recently released book, focused on Topol's belief that right now is medicine's "kairos", the Greek term for a supreme, opportune moment. "We're moving from the population level to the individual level" in health, he said. The digital world and the longstanding medical world cocoon are intersecting, creating an "extraordinary" convergence.



Cardiac Auscultation

“The Big 12”

2nd Sound Splitting*

Third Sound*

Fourth Sound*

Systolic Clicks

Innocent Murmur

Mitral Regurgitation*

Aortic Stenosis*

Aortic Regurgitation*

Mitral Stenosis*

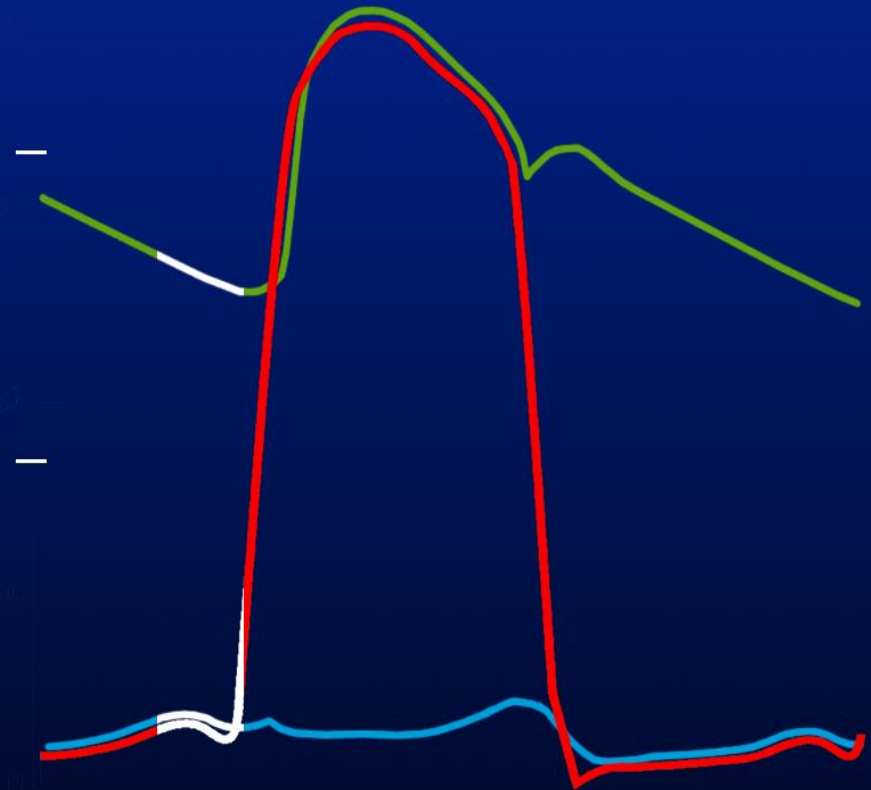
Continuous Murmur

Tricuspid Regurgitation*

Pericardial Rub

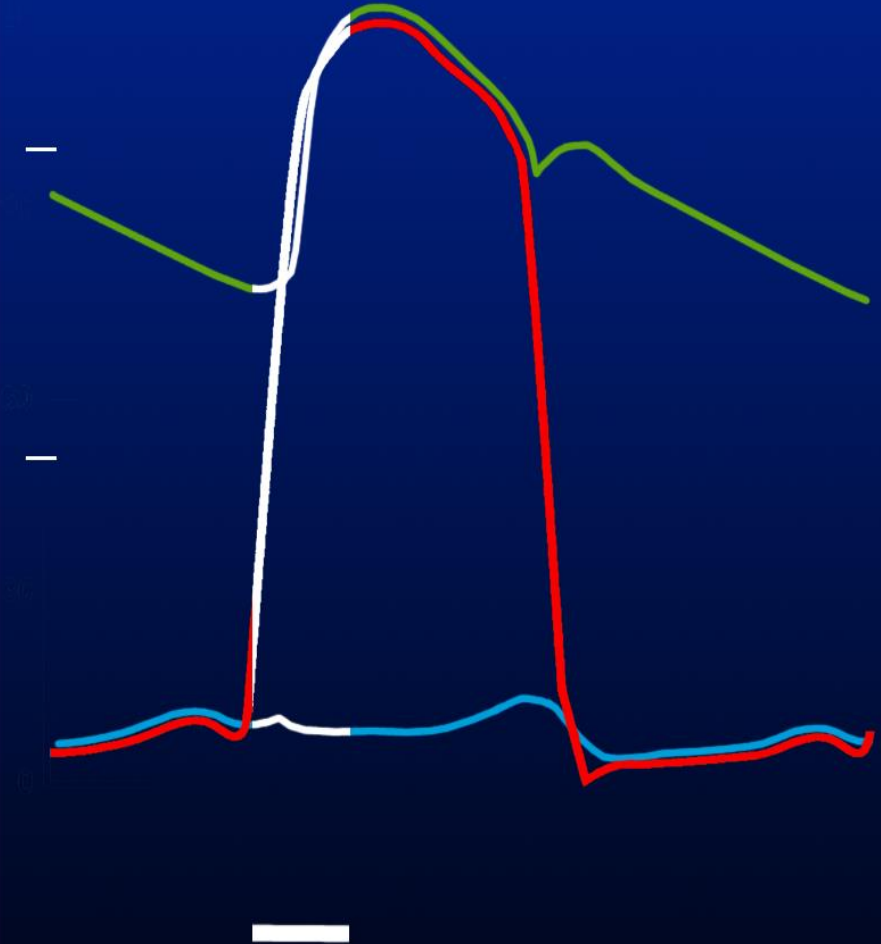
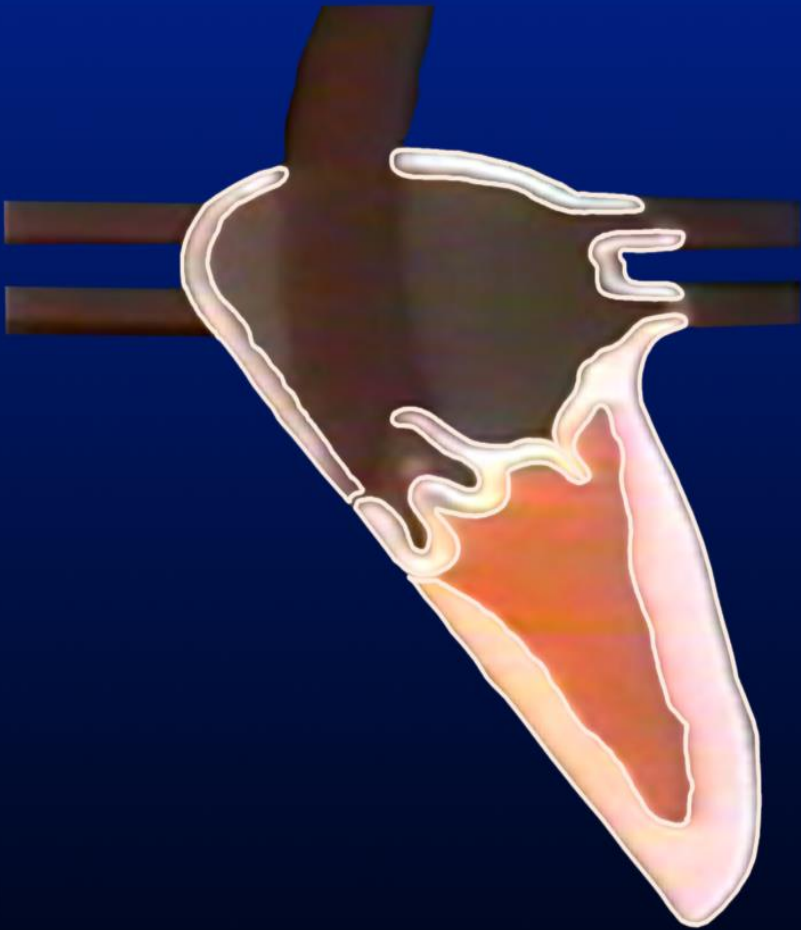


S1: closing of mitral valve

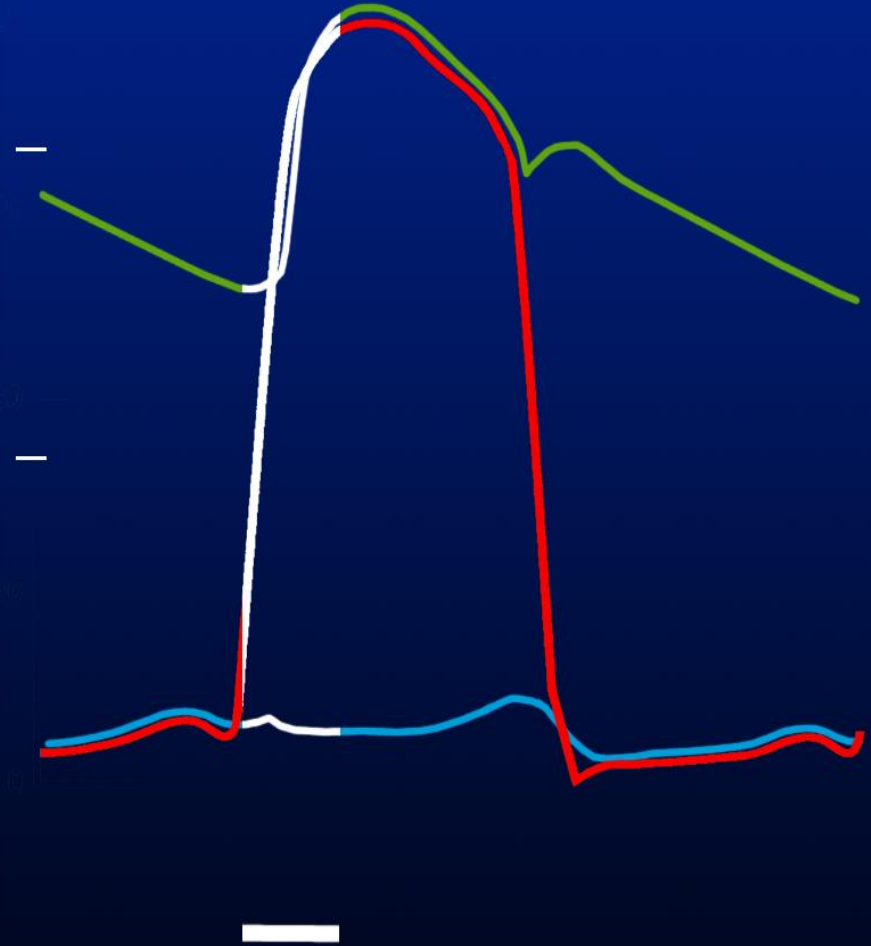
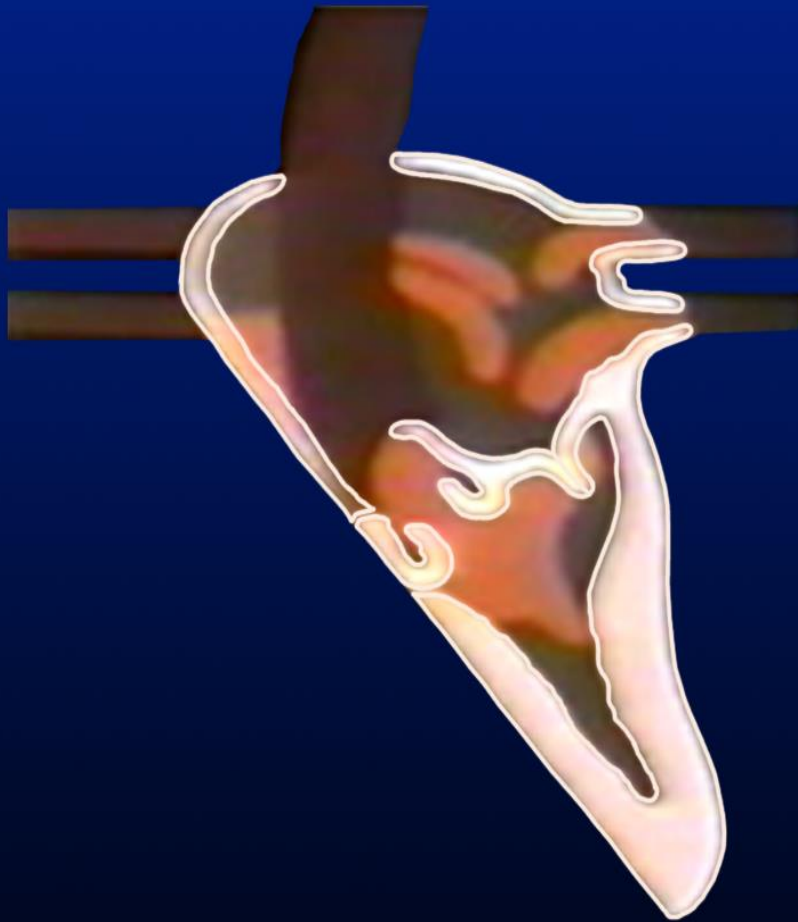


┐
S1

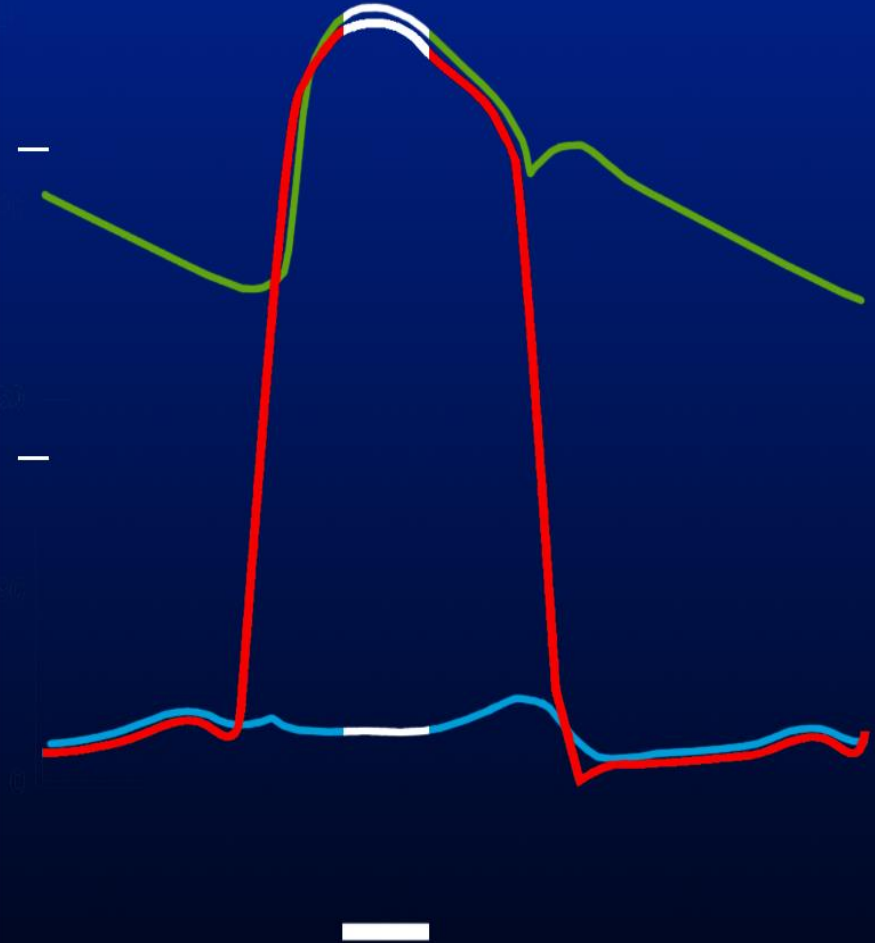
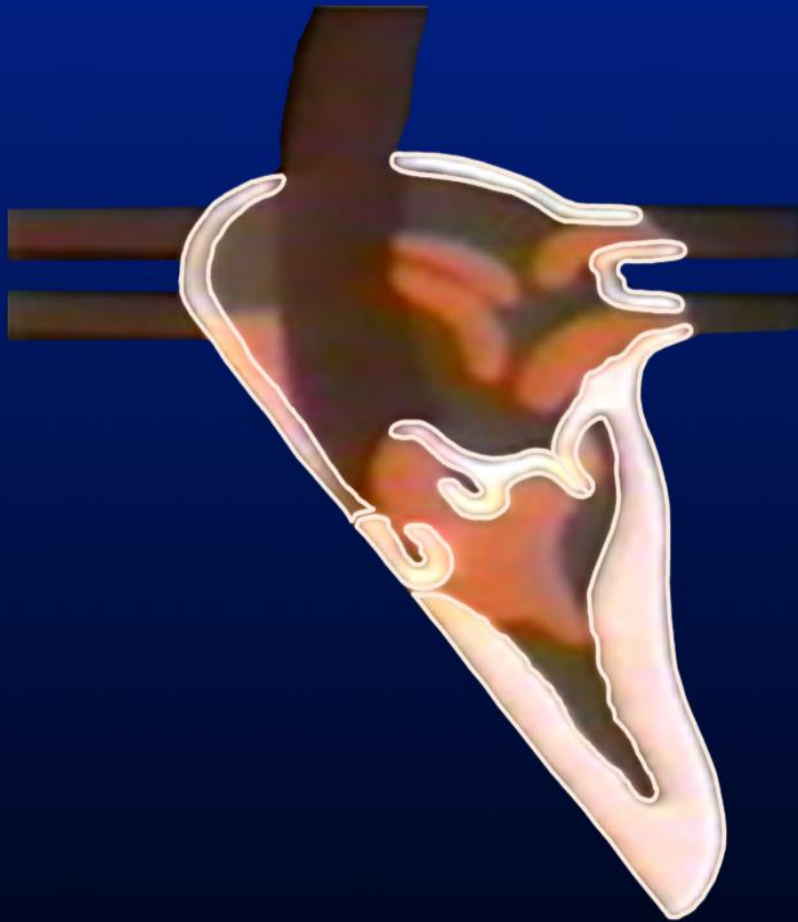
Isometric contraction



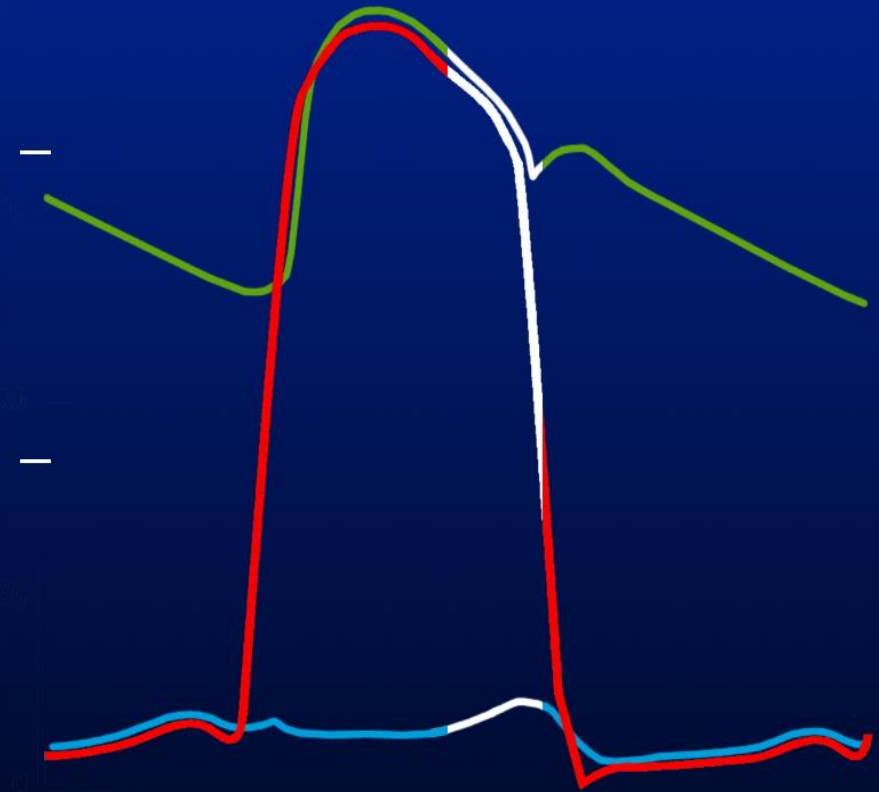
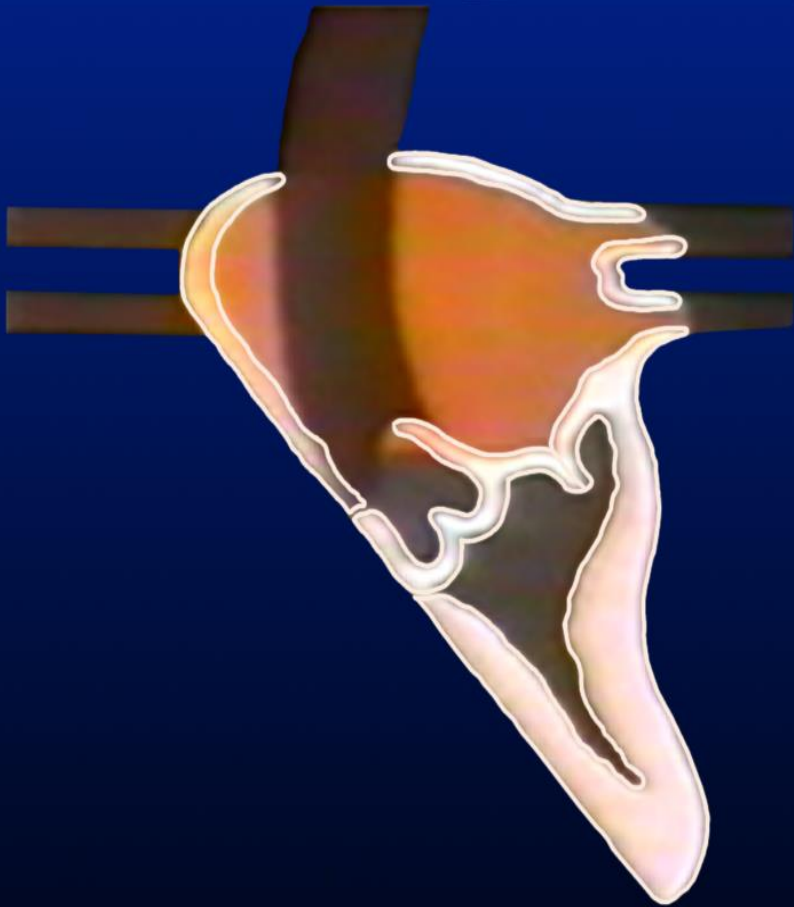
Opening of aortic valve



Normally, no Systolic Sound

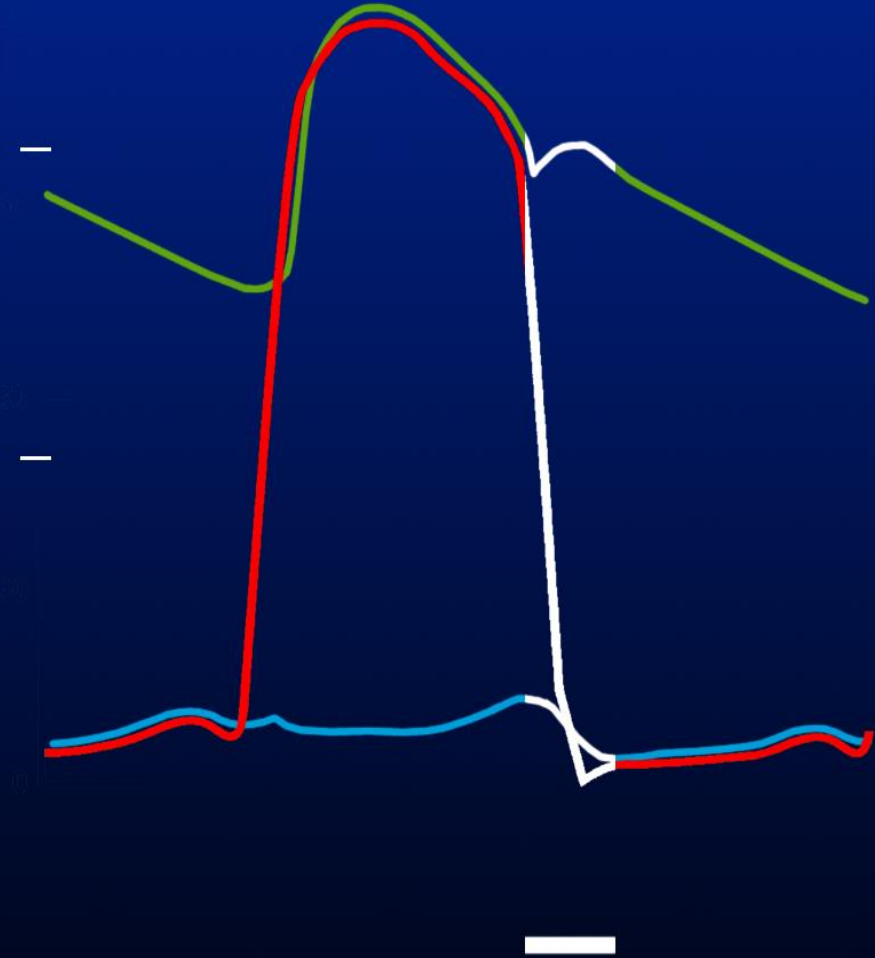


S2 : closing of aortic valve

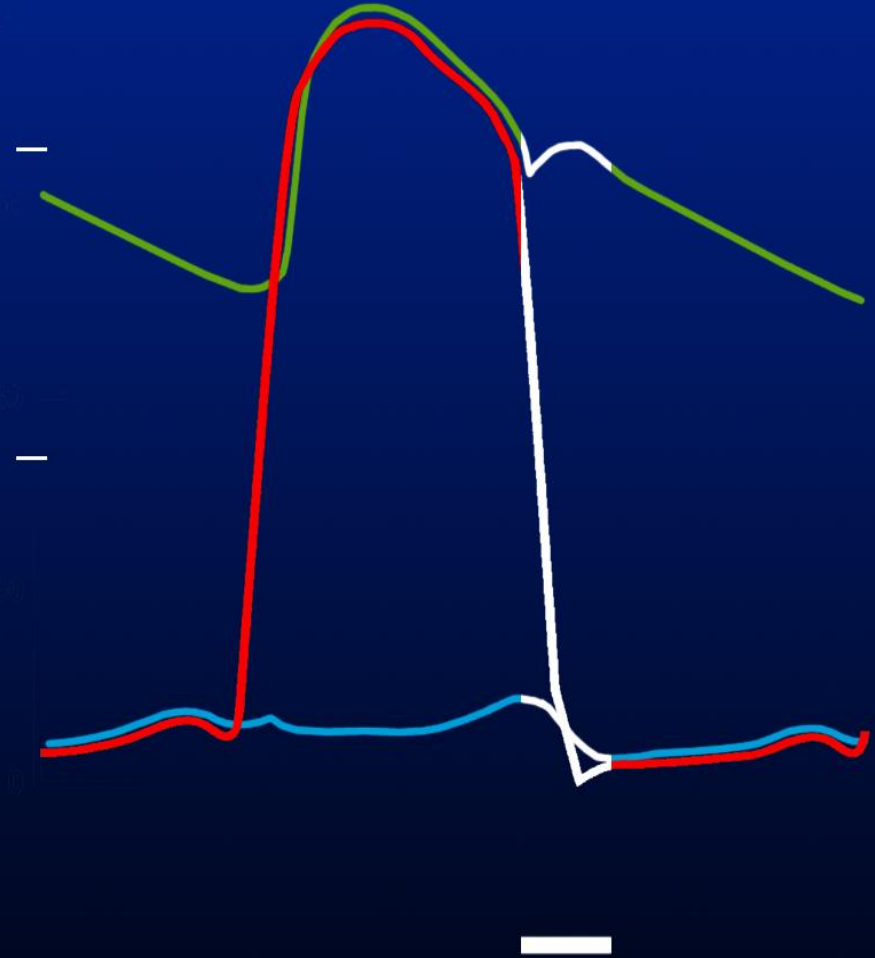


S2

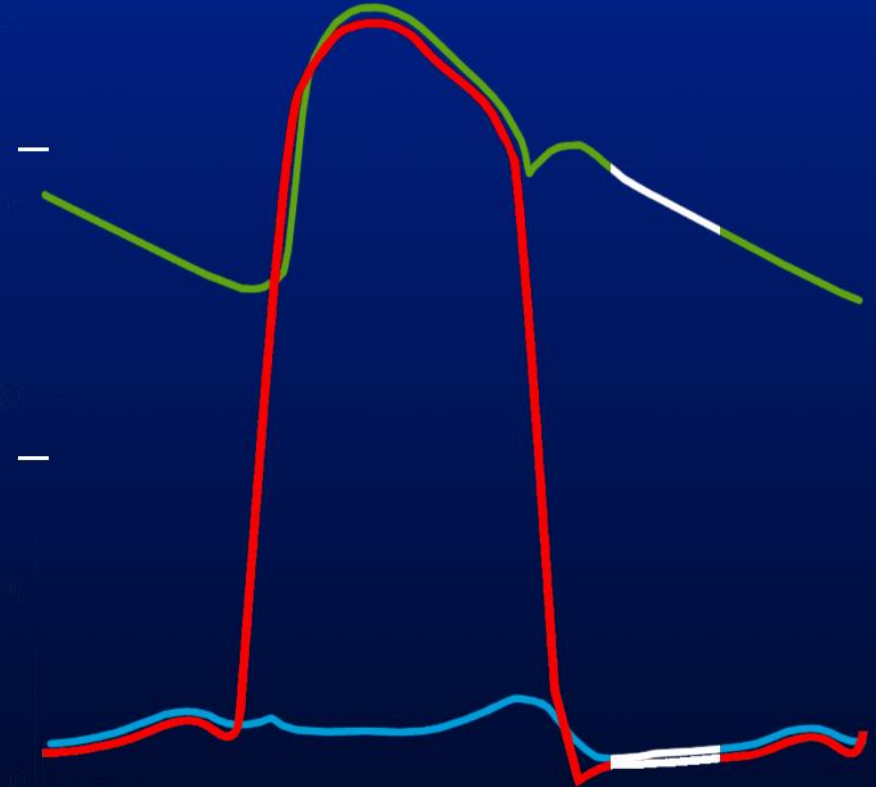
Early isometric relaxation



Opening of mitral valve

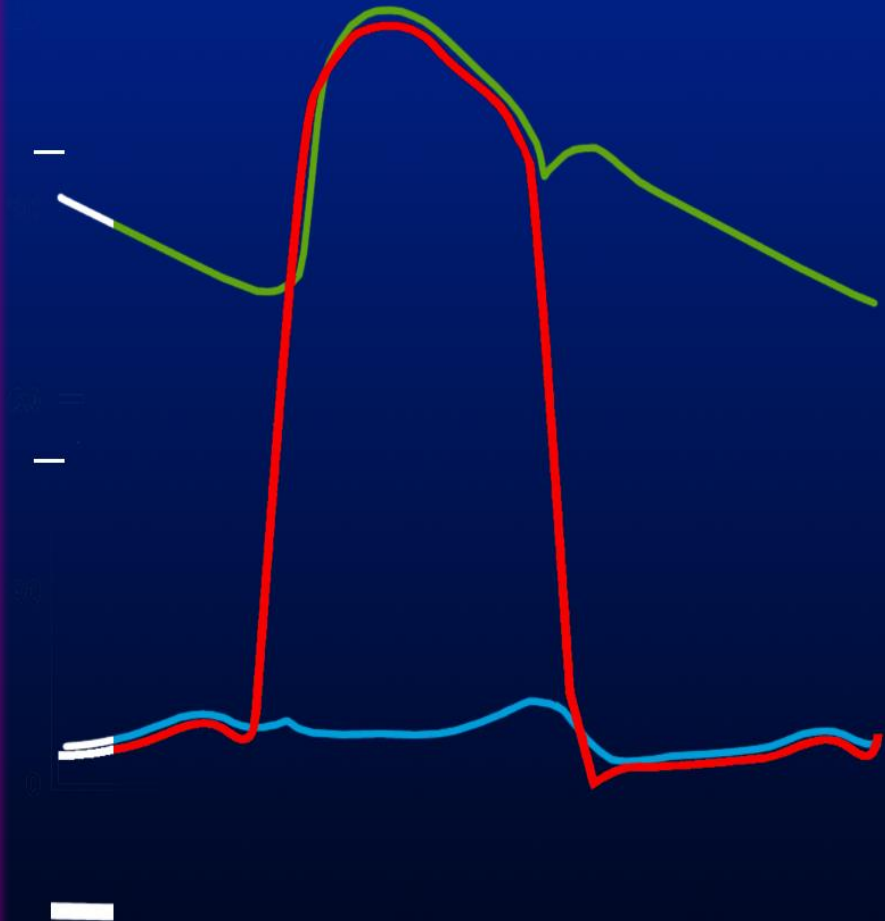


Early passive filling of LV

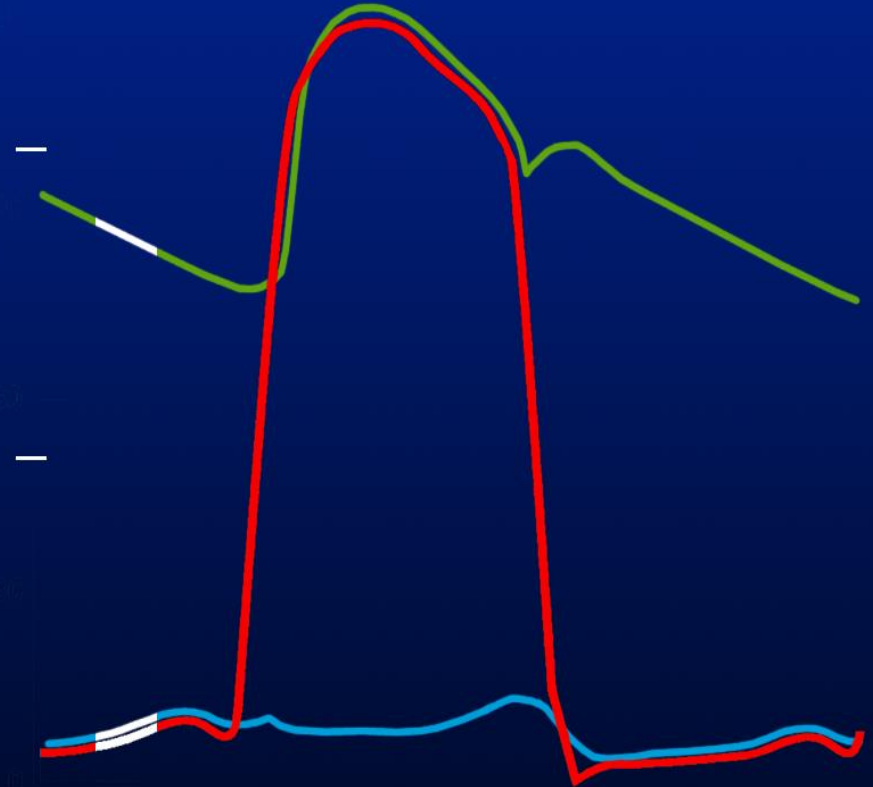


sometimes S3

Mid diastoly



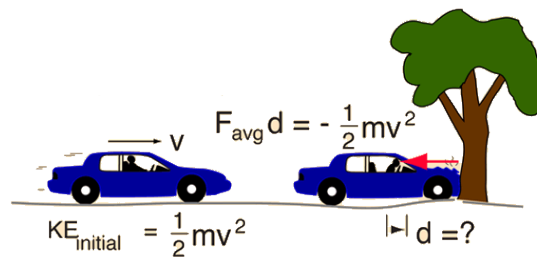
Active filling of LV < atrial contraction



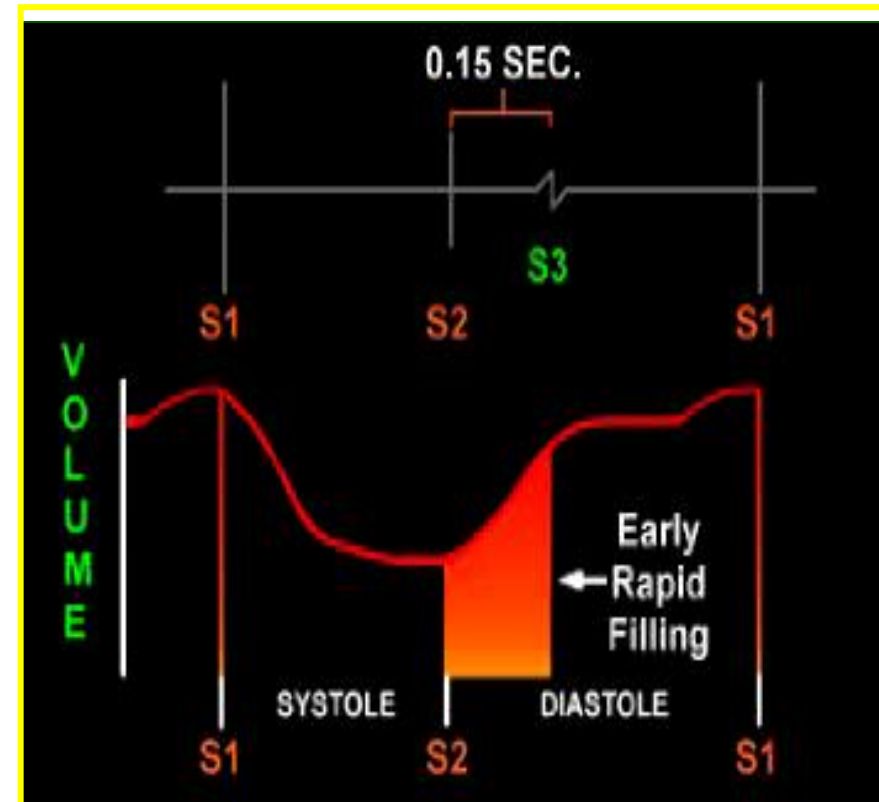
sometimes S4

Mechanism of S3 & S4

- Blood deceleration

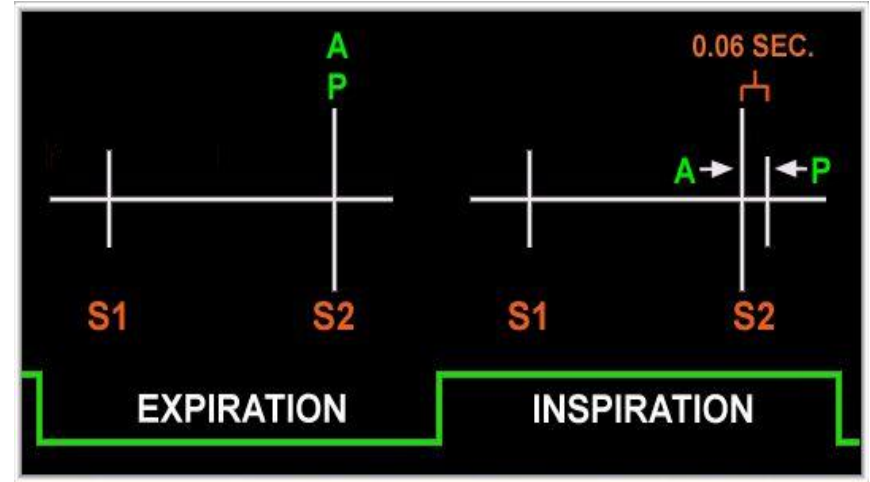
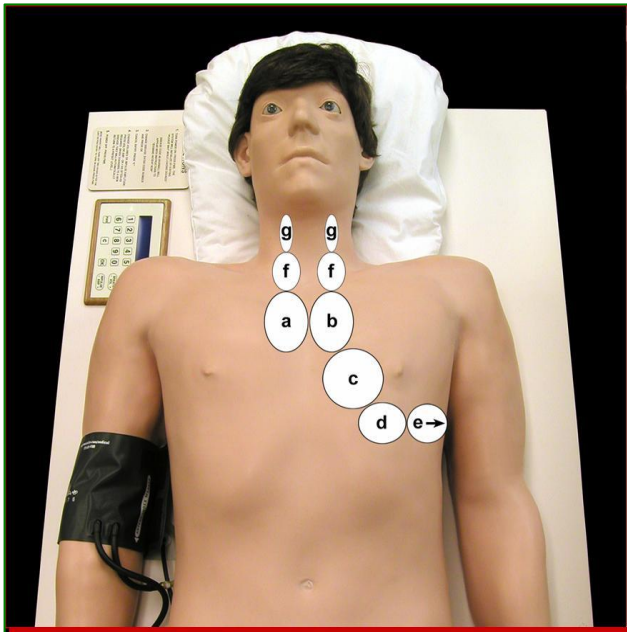


- Normal: young /athlete
- Pathological
 - Heart failure
 - Regurgitation



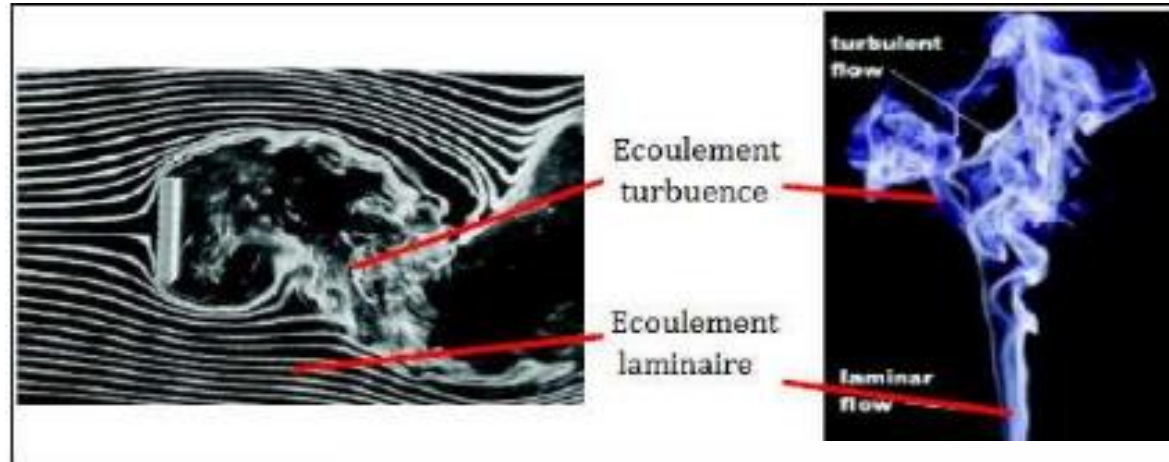
S2 Splitting

- S2 splitting
 - ↑ venous return
 - ↑ pulmonary compliance
 - ↑ compression of liver



b Pulmonaire

Cardiac Murmurs



Laminar

TRANSITION LAMINAIRE - TURBULENT

Turbulent

Reynolds < 2000

>3000

$$Re = \frac{V \cdot D}{\nu} = \frac{\rho \cdot V \cdot D}{\mu}$$

Re : nombre de Reynolds s.u.

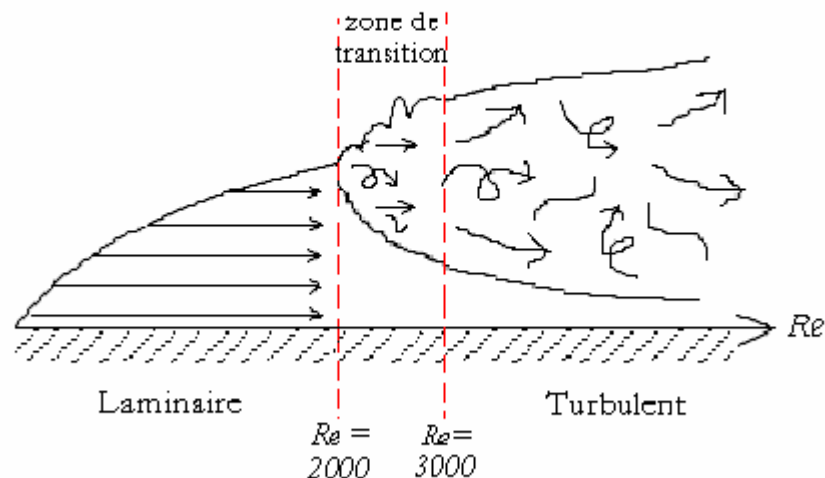
V : vitesse débitante en m/s

D : diamètre en m

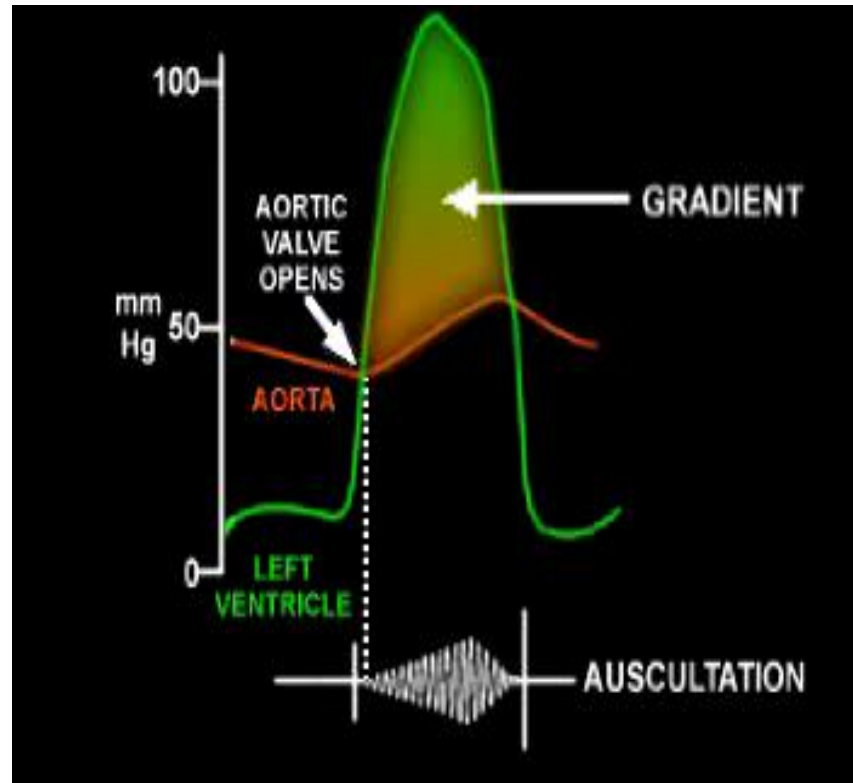
ν : viscosité cinématique en m^2/s

μ : viscosité dynamique en $kg/(m.s)$

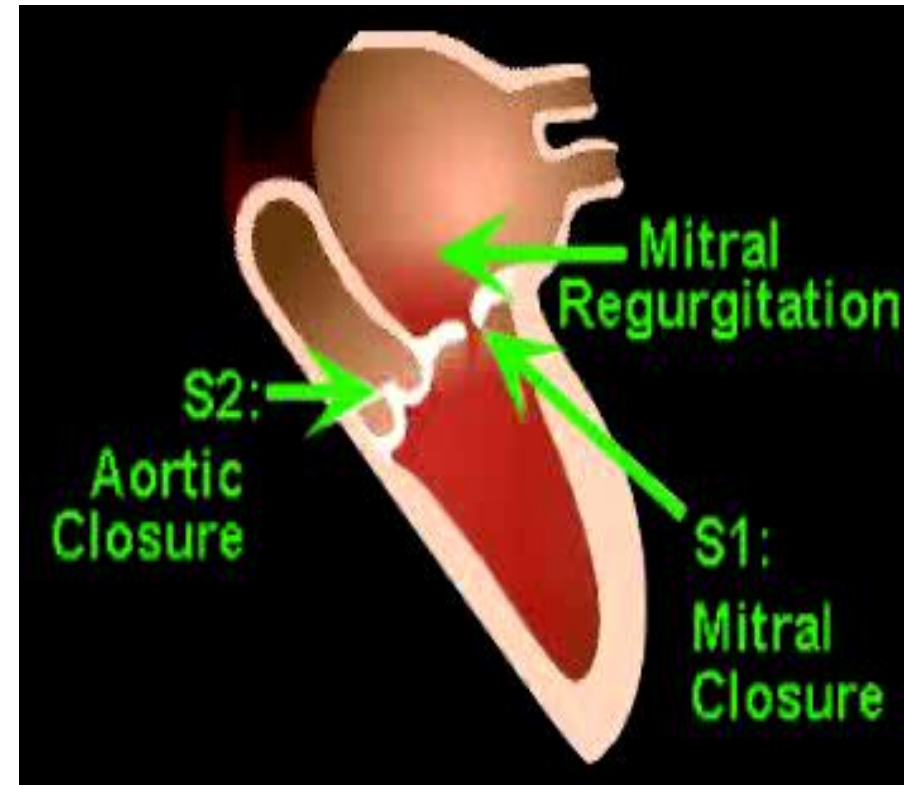
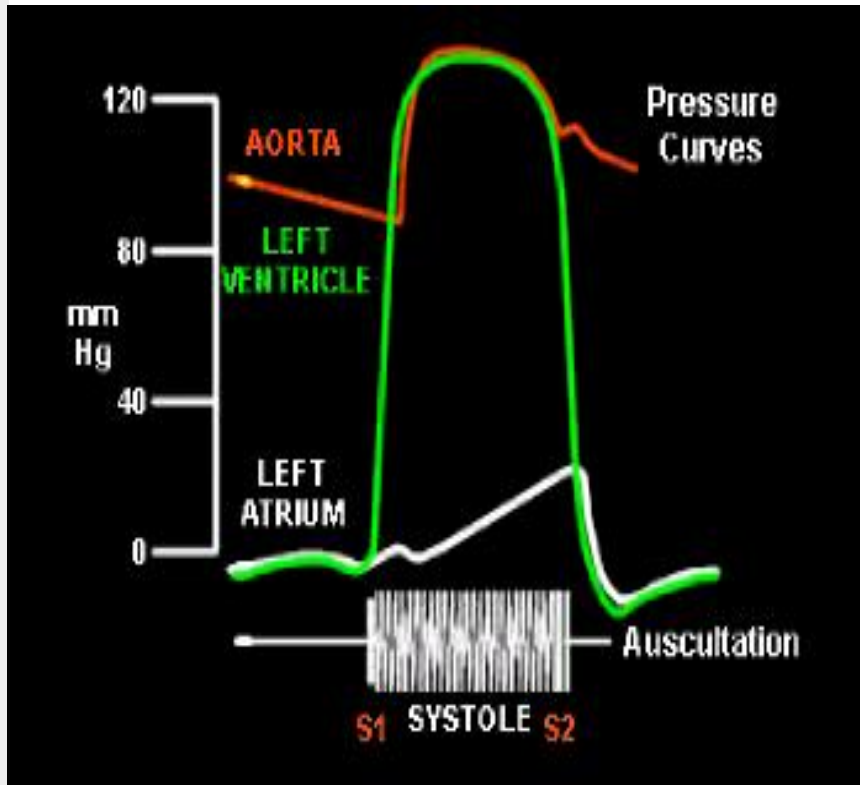
ρ : masse volumique en kg/m^3



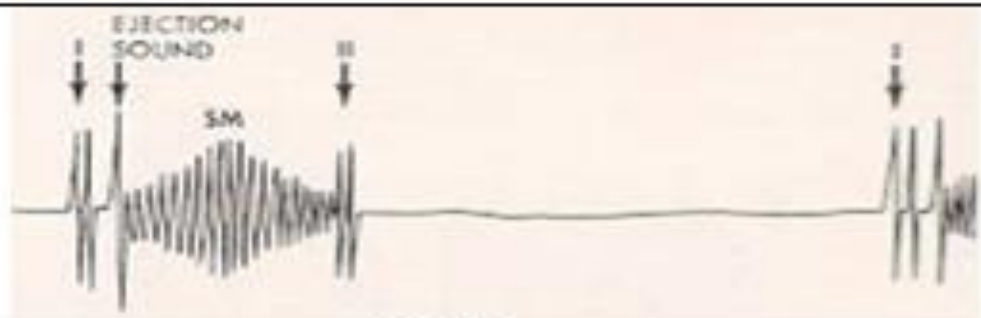
Aortic Stenosis



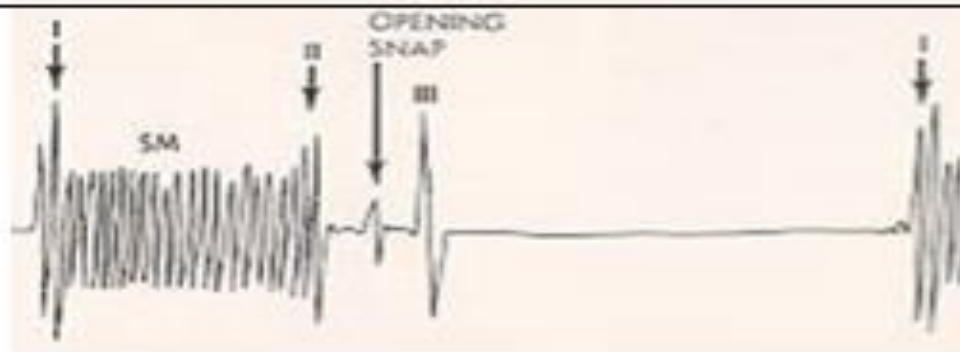
Mitral Regurgitation



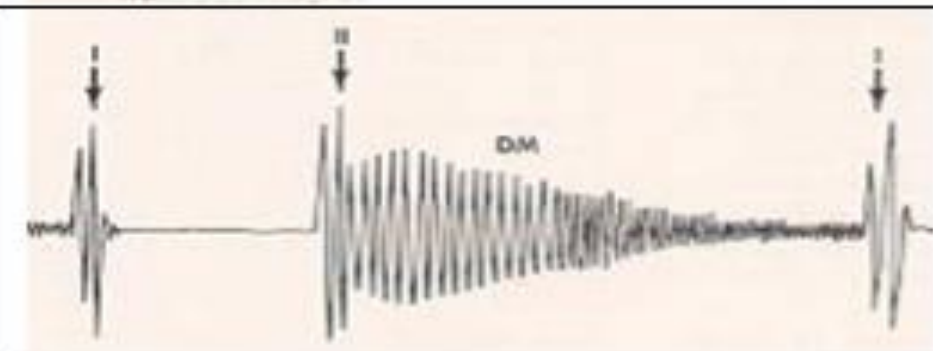
Systolic vs Diastolic Murmurs



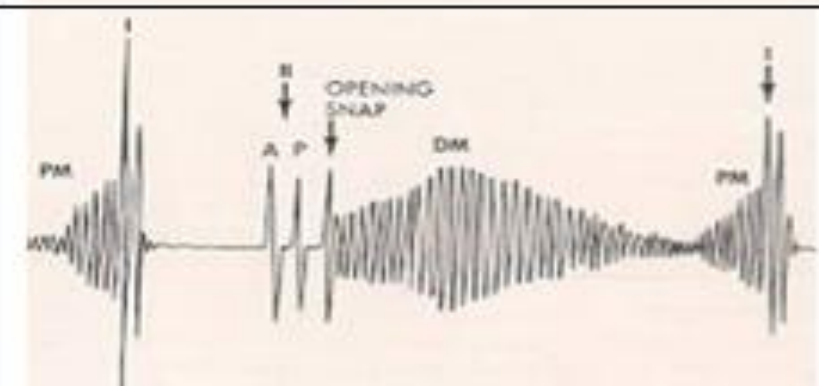
- Aortic Stenosis



- Mitral Regurgitation



- Aortic Regurgitation



- Mitral Stenosis