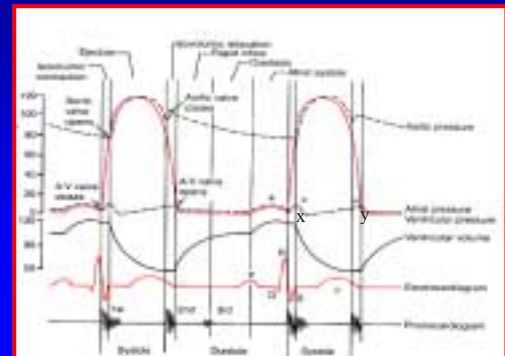


PHYSICAL EXAMINATION CARDIOVASCULAR SYSTEM

Mervyn Gotsman M.D.

Department of Cardiology, Hadassah
University Hospital, Hebrew University -
Hadassah Medical School, Jerusalem,
Israel

The Wiggers Diagram



PHYSICAL EXAMINATION CARDIOVASCULAR SYSTEM

- General examination
- Arterial pulse - brachial, carotids, peripheral
- Jugular Venous Pressure
- The heart
 - Inspection
 - Palpation
 - Percussion
 - Auscultation

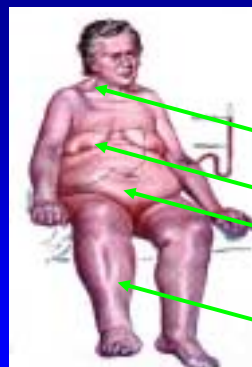
CARDIOVASCULAR SYSTEM General examination

- Walking and gait
- Sitting or lying
- Orthopnoea
- Cyanosis (central or peripheral), anaemia, jaundice
- Fever and embolic signs
- Right heart failure (JVP, dependent oedema, hepatomegaly, ascites, pleural effusions)
- Left heart failure (dyspnoea, tachypnoea, orthopnoea, cough, basal crepitations)
- Pulmonary disease
- Systemic disease: thyrotoxicosis, scleroderma, lupus erythematosus, etc



Left Heart Failure

- Elevated LVEDP
 - LAP
 - PVP
- Pulmonary congestion
- Dyspnoea
- Orthopnoea
- Cough
- Tiredness and lethargy



Right Heart Failure

- JVP
- Hepatic Ascites
- Ankle Edema

Weight

PHYSICAL EXAMINATION CARDIOVASCULAR SYSTEM

- **Arterial pulse**
- Jugular Venous Pressure
- Cardiac Examination:
 - Inspection
 - Palpation
 - Percussion
 - Auscultation

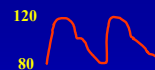
Arterial pulse Radial artery



Arterial pulse Radial artery

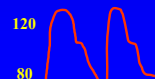
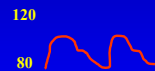
- Heart rate: (60-100).
- Rhythm: **Regular**
- **Irregular:** Sinus arrhythmia
- **Occasional** - Premature beats
- **Totally** - irregular

Arterial pulse Carotid artery



Amplitude/Contour:

- **Hypokinetic** ↓ (weak) - Hypovolemia
Heart failure
Aortic stenosis
- **Hyperkinetic** ↑ increased stroke volume
Fever, anemia, hyperthyroidism
AR, bradycardia, atherosclerosis

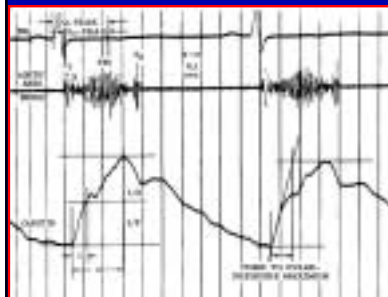


Arterial pulse: Carotid artery

Amplitude/Contour:

- **Bisferiens** - HOCUM
- **Collapsing** - AR
- **Parvus et tardus** - AS
- **Alternans** - Heart failure
- **Bigeminal** - Premature beats
- **Paradoxical** - Pericardial tamponade
- Constrictive pericarditis
- **Dicrotic** - Cardiomyopathy
- **Filiform** - shock

Pulsus parvus et tardus



The phono-carotid pulse tracing:

- Phono
 - Long systolic ejection murmur
 - Paradoxical split of the 2nd heart sound
- Carotid pulse tracing
 - Pulsus parvus et tardus

PHYSICAL EXAMINATION CARDIOVASCULAR SYSTEM

- Arterial pulse
- **Jugular Venous Pressure**
- The heart
 - Inspection
 - Palpation
 - Percussion
 - Auscultation

Jugular Venous Pressure 45° angle



Jugular Venous Pressure



Jugular Venous Pressure

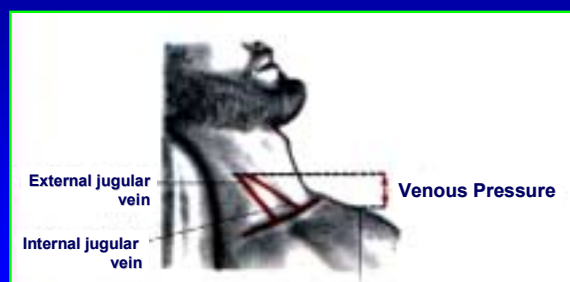
Patient at 30 degrees and oblique lighting
Differentiation from arterial pressure

- Two waves (if not in A fib)
- Changes with position
- Obliterated with pressure
- Decreases with respiration

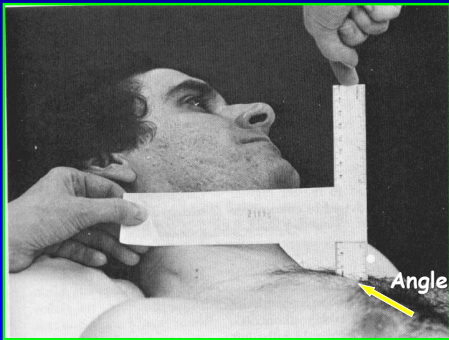
Jugular Venous Pressure

- **Reflects**
 - Right atrial pressure
 - Blood volume
 - Tricuspid valve
 - Diastolic events in the right ventricle
- **Estimate CVP**
 - Maximal 3cm from sternal angle
 - + 5cm from atrium (Right atrial pressure)
- **Increased pressure**
 - Right sided heart failure
 - Constrictive pericarditis
 - Tricuspid stenosis
 - Obstructed SVC
 - Increased intrathoracic pressure

Jugular Venous Pressure

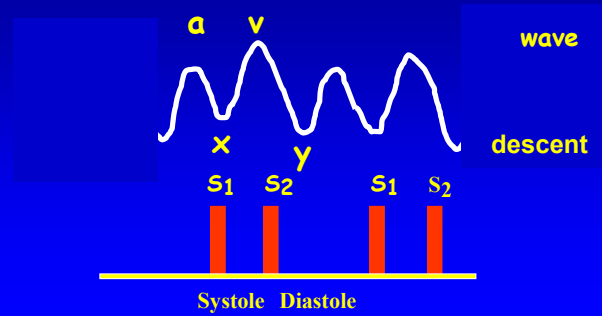


Jugular Venous Pressure



Angle of Lewis

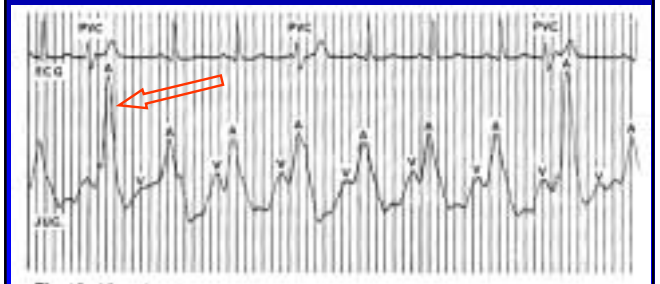
Jugular Venous Pressure



Jugular Venous Pressure

- **Amplitude of pulsations**
a wave, x descent, v wave, y descent
Atrial contraction, relaxation, atrial filling, emptying
- **Absent 'a' wave** - atrial fibrillation
- **Giant 'a' wave** - tricuspid Stenosis, PHT
- **Cannon 'a' waves** - AV dissociation
- **Large 'v' wave** - tricuspid regurgitation
- **Slow 'y' descent** - tricuspid stenosis

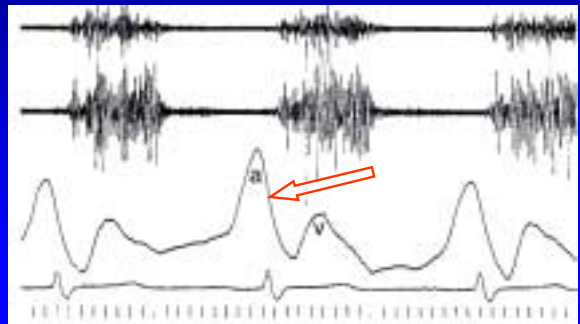
Jugular Venous Pressure Diagnosis ?



תמונה מס' 1 מראה

- גל תותח
- גל A גבוה
- גל V בולט
- ירידת 'Y' חזקה

Jugular Venous Pressure Diagnosis ?



תמונה מס' 2 מראה:

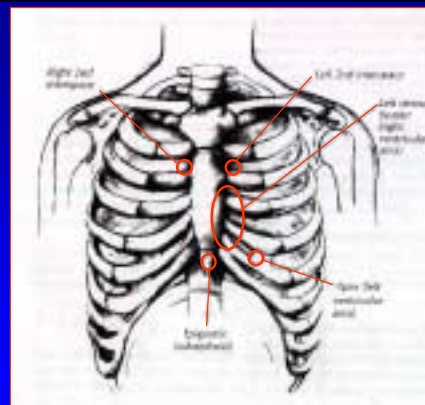
- א. הצרות של המסתם הוטיני.
- ב. הצרות של המסתם הדו-צניפי.
- ג. יתר לחץ דם ריאתי.
- ד. אי ספיקה של המסתם התלת-צניפי

Jugular Venous Pressure

- **Hepatojugular reflux** - Sustained rise of JVP Heart failure.
- **Kussmaul's sign** - Increase with inspiration Constrictive pericarditis Heart failure

PHYSICAL EXAMINATION CARDIOVASCULAR SYSTEM

- Arterial pulse
- Jugular Venous Pressure
- Cardiac Examination
 - Inspection
 - Palpation
 - Percussion
 - Auscultation



Cardiac Examination: Inspection



Cardiac Examination: Inspection

Cardiac pulsations

PMI

Parasternal lift

S3, S4

Dyskinesis

Aneurysm

PHYSICAL EXAMINATION: CARDIOVASCULAR SYSTEM

- Arterial pulse
- Jugular Venous Pressure
- Cardiac Examination
 - Inspection
 - Palpation
 - Percussion
 - Auscultation

Cardiac Examination: Palpation

Areas of palpation

- Apical impulse (PMI)
- Left sternal border
- Left and right 2nd interspace
- Epigastric area
- Thrills

Cardiac Examination: Palpation



- Apical impulse (PMI)

Cardiac Examination: Palpation



- Apical impulse (PMI)

Cardiac Examination: Palpation



- Apical impulse (PMI)

Cardiac Examination - Palpation

Left parasternal lift

- Right ventricular volume load
 - ASD
 - Pulmonary incompetence
 - Tricuspid incompetence - see-saw motion
- Right ventricular pressure load
 - Pulmonary hypertension
 - Pulmonary stenosis
- Left atrial lift
 - Mitral incompetence

Cardiac Examination: Palpation



- Left sternal border - Right ventricle

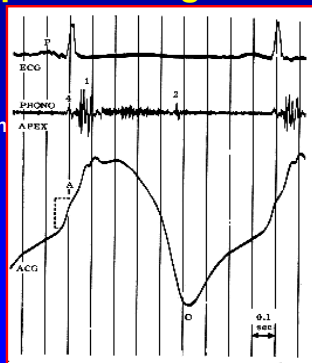
Cardiac Examination: Palpation

- Left 2nd interspace - Pulmonic: PHT
- Right 2nd interspace - Aortic: HTN
- Epigastric area -
 - Right ventricle in hyperinflated lungs
- Thrills - Murmurs grade 4+

The normal apex-cardiogram

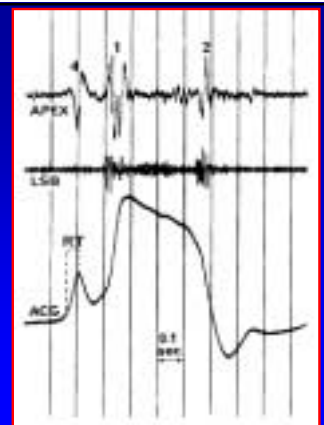
The normal apex cardiogram:

- Normal outward motion fills the first third of systole
- Small presystolic outward motion
- Rapid filling wave



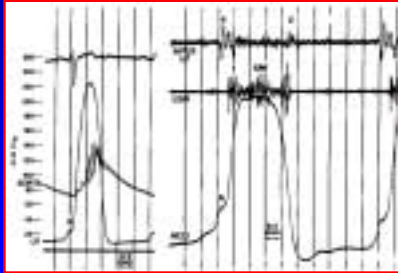
Apexcardiogram in aortic stenosis

- Prominent outward presystolic motion
- Prolonged sustained outward motion fills all of systole



Apexcardiogram in aortic stenosis

- Prominent outward presystolic motion
- Prolonged sustained outward motion fills all of systole



תמונה מס' 4 מראה

- א. חוד מוסט שמאלה.
- ב. חוד עם הולם מאורך.
- ג. דופק מתמוטט.
- ד. הרמה של חדר ימני.

PHYSICAL EXAMINATION CARDIOVASCULAR SYSTEM

- Arterial pulse
- Jugular Venous Pressure
- Cardiac Examination
 - Inspection
 - Palpation
 - Percussion
 - Auscultation

Cardiac Examination: Auscultation

Areas of auscultation

- Apex
- Left Sternal Border
- Aortic
- Pulmonic

Cardiac Examination: Auscultation



Areas of auscultation: Apex

Cardiac Examination: Auscultation



Areas of auscultation: Left Sternal Border

Cardiac Examination: Auscultation



Areas of auscultation: Aortic, Pulmonic

Cardiac Examination: Auscultation

Stethoscope

- Diaphragm (high pitched) - S1, S2, AR, MR, clicks, friction rubs
- Bell (low pitched) - S3, S4, MS.

Position

- Left decubitus - S3, S4, mitral sounds (MS)
- Lean forward and exhale - Aortic (AR)

Cardiac Examination: Auscultation



Lean forward and exhale

Cardiac Examination: Auscultation



Left decubitus

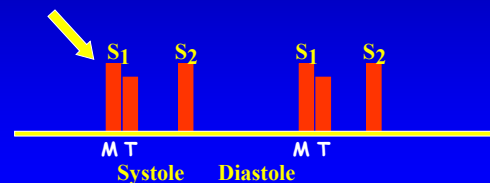
The Wiggers Diagram



Cardiac Examination: Auscultation

- First heart sound (S1):

Closure of Mitral and Tricuspid valves



Cardiac Examination: Auscultation

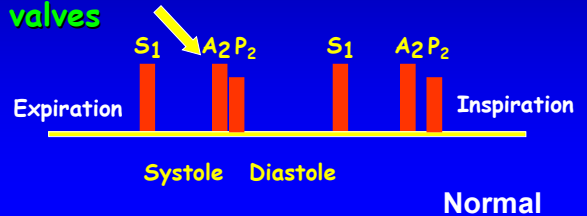
First heart sound (S1)

- Intensity
 - LV dp/dt
 - P-R interval
 - Short PR - loud
 - Long PR - soft
- Accentuated:
 - Short PR interval
 - high cardiac output states
 - MS
- Diminished
 - 1st degree AVB,
 - MR.
- Splitting
 - RBBB
 - VPB's.

Cardiac Examination: Auscultation

• Second heart sound (S2):

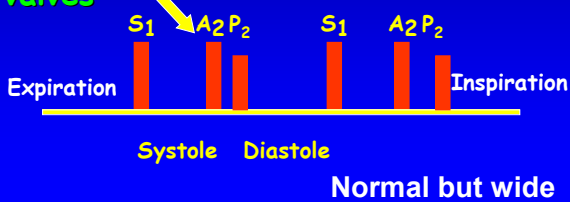
Closure of Aortic and Pulmonic valves



Cardiac Examination: Auscultation

• Second heart sound (S2):

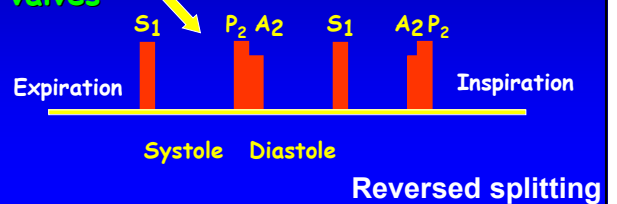
Closure of Aortic and Pulmonic valves



Cardiac Examination: Auscultation

• Second heart sound (S2):

Closure of Aortic and Pulmonic valves



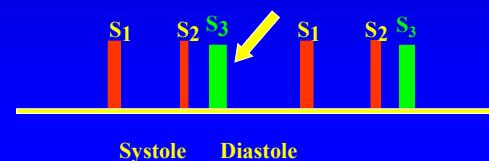
Cardiac Examination: Auscultation

- Second heart sound (S²-A², P²)
- Single- common ventricle or truncus, valve atresia
- Fixed splitting - ASD
- Splitting is due to differences in LV and RV systolic duration
- RVET > LVET
- Wider splitting
 - Longer RVET - overloading
 - Shorter LVET - underloading
- Paradoxical splitting
 - Longer LVET - overloading
 - Shorter RVET - underloading

Cardiac Examination: Auscultation

Third heart sound (S3)

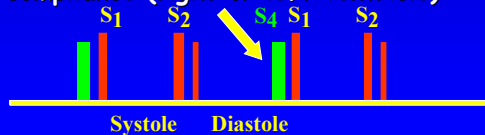
- Sudden expansion of the ventricle by rapid ventricular filling
- Often palpable
- Physiological in young people and during exercise
- Pathological in volume overload and heart failure



Cardiac Examination: Auscultation

Fourth heart sound (S4)

- Sudden expansion of the ventricle (right or left) by atrial contraction
- Physiological in athletes, older people.
- Pathological due to decreased compliance (right or left ventricle)



Cardiac Examination: Auscultation

Fourth heart sound (S4)

- Physiological in athletes, older people
- Pathological due to decreased compliance (thick wall or poor relaxation)
 - Pressure overload - HTN, AS
 - Ischemia, Cardiomyopathies
- Right sided S4: pressure overload (PS, PHT)
- Accentuated by exercise

Cardiac Examination: Auscultation

Extra systolic sounds:

- Ejection sound
 - Aortic
 - Pulmonary
- Midsystolic click
 - Mitral Valve Prolapse

Extra diastolic sounds:

- Opening snap
 - Mitral Stenosis

Cardiac Examination: Auscultation

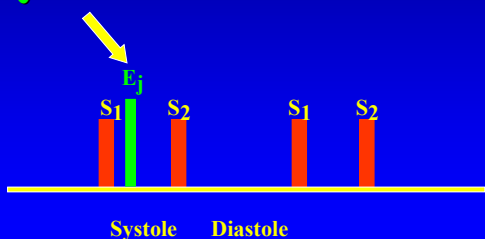
Ejection sound : Left or right

- Valve stenosis
- Increased blood flow through the valve
- Arterial hypertension
- Dilatation of the artery

Cardiac Examination: Auscultation

Extra systolic sounds:

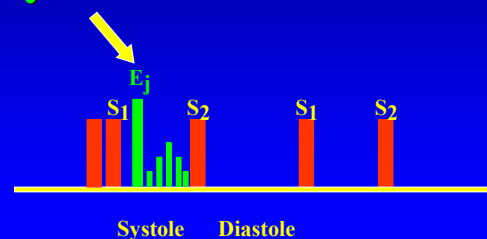
- Ejection sound: Aortic Stenosis



Cardiac Examination: Auscultation

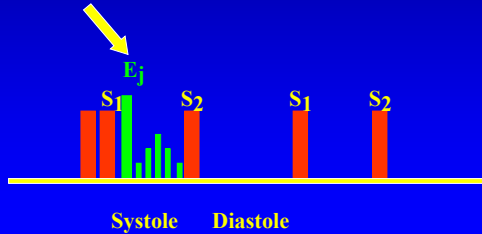
Extra systolic sounds:

- Ejection sound: Aortic Stenosis



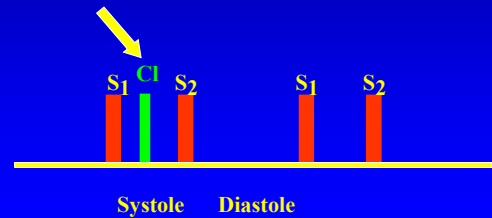
Cardiac Examination: Auscultation Extra systolic sounds:

- **Ejection sound:** Aortic Stenosis



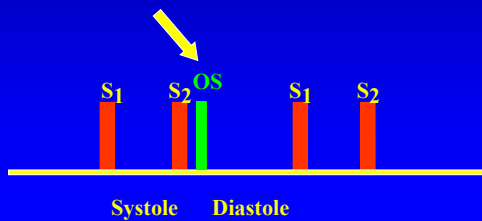
Cardiac Examination: Auscultation Extra systolic sounds:

- **Midsystolic click:** Mitral Valve Prolapse



Cardiac Examination: Auscultation Extra diastolic sounds:

- **Opening snap:** Mitral or tricuspid stenosis
- **Severe stenosis - shorter 2-os interval**



Cardiac Examination: Auscultation

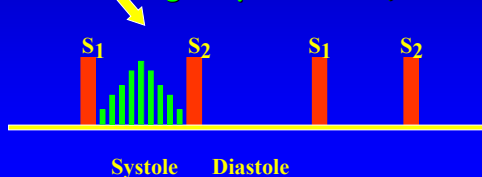
Murmurs:

- **Timing** - Systolic - (mid, pan)
Diastolic - (early, mid, late).
- **Shape** - crescendo, decrescendo, plateau.
- **Location**
- **Radiation** - Axilla, Back, Suprasternal notch
- **Intensity** (1 - 6).
- **Pitch**
- **Quality** - blowing, harsh, rumbling, musical
- **Changes** with physiological interventions - exercise, standing, squatting, Valsalva

Cardiac Examination: Auscultation

Murmurs:

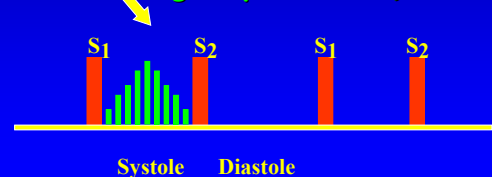
- **Ejection:** Left and right ventricular outflow tract stenosis (subvalvular, valvular ring, supra-valvular)



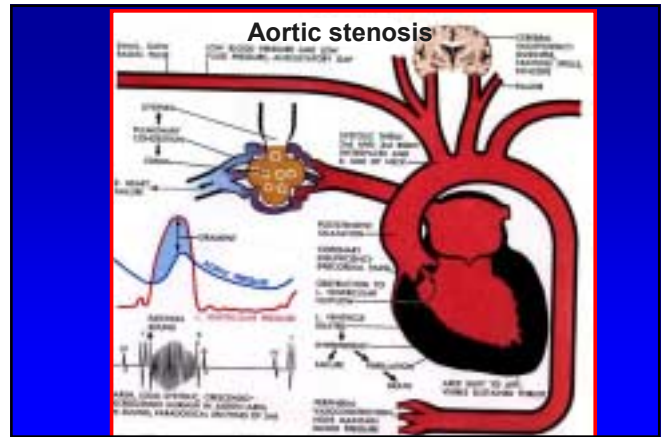
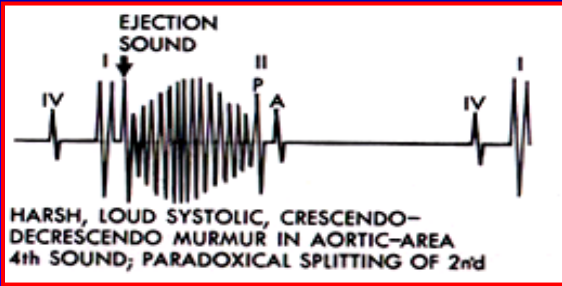
Cardiac Examination: Auscultation

Murmurs:

- **Ejection:** Left and right ventricular outflow tract stenosis (subvalvular, valvular ring, supra-valvular)

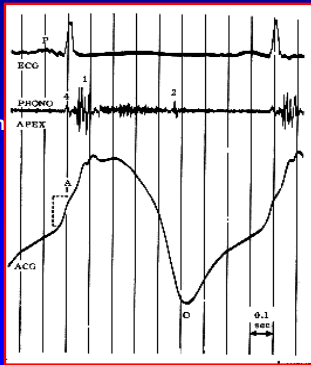


Aortic stenosis - murmur



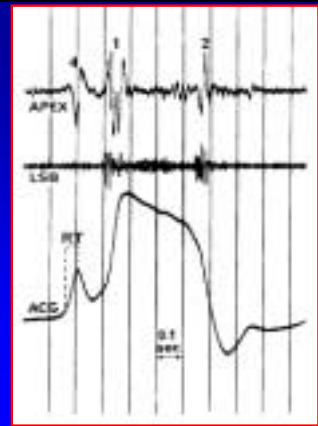
The normal apex-cardiogram

- The normal apex cardiogram:
- Normal outward motion fills the first third of systole
 - Small presystolic outward motion
 - Rapid filling wave



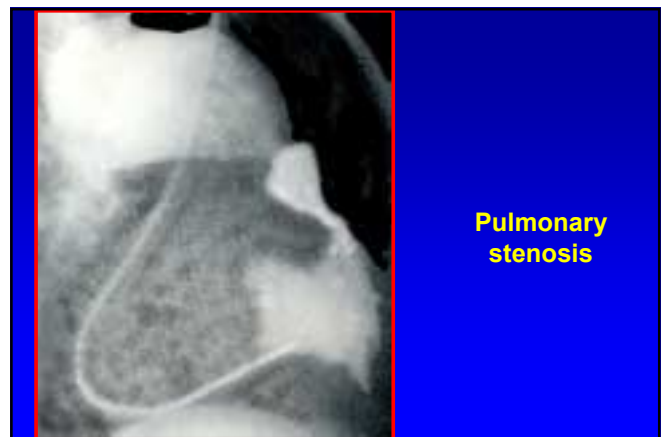
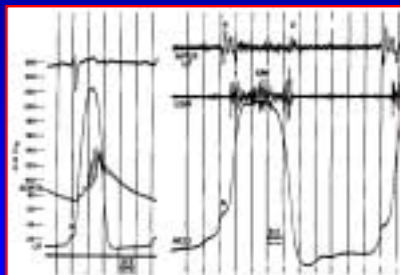
Apexcardiogram in aortic stenosis

- Prominent outward presystolic motion
- Prolonged sustained outward motion fills all of systole



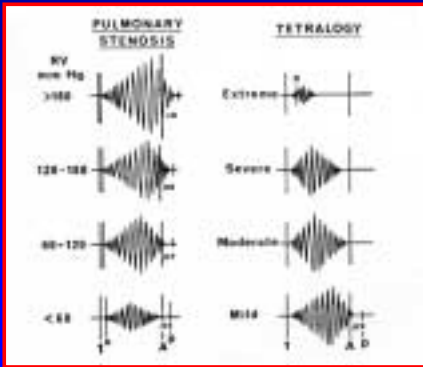
Apexcardiogram in aortic stenosis

- Prominent outward presystolic motion
- Prolonged sustained outward motion fills all of systole

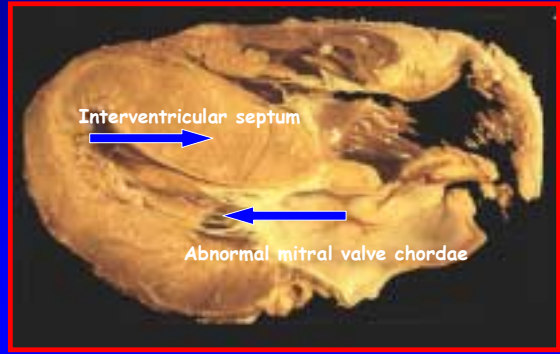


Pulmonary stenosis

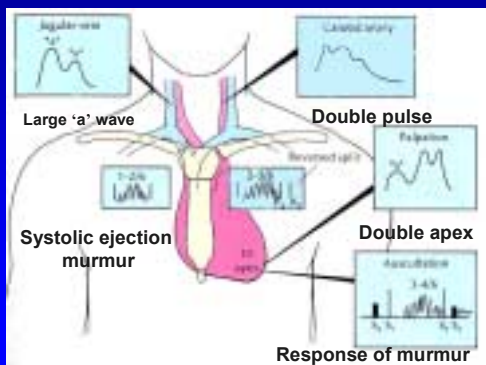
Right ventricular outflow tract stenosis



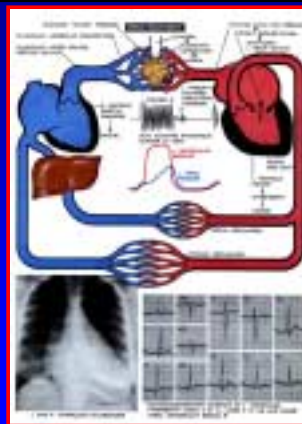
Hypertrophic myopathy



HOCUM



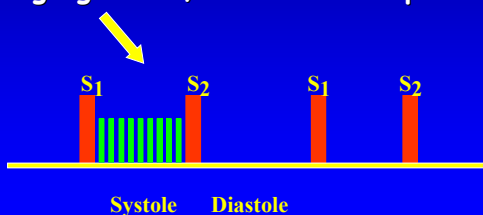
Mitral incompetence



Cardiac Examination: Auscultation

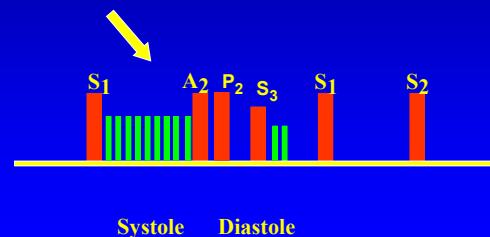
Murmurs:

- **Pansystolic:** Mitral, Tricuspid Regurgitation, Ventricular septal defect



Cardiac Examination: Auscultation

Severe MR



תמונה מס' 5 מראה:

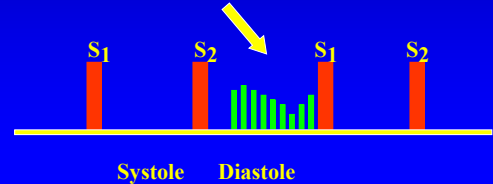
הדבר שאנו הבולט באי ספיקה קשה של המסתם הדו-צניפי הם:

- א- אישה פן סיסטולית.
- ב- פיצול רחב של הקול השני.
- ג- קול שלישי.
- ד- קול רביעי חזק.

Cardiac Examination: Auscultation

Murmurs:

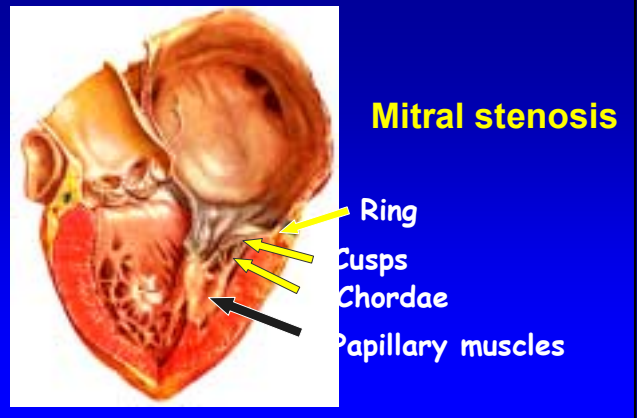
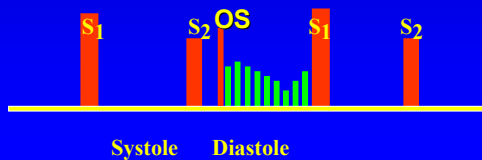
- Mid-diastolic+presystolic
- Mitral, tricuspid stenosis
- Mid diastolic flow murmurs



Cardiac Examination: Auscultation

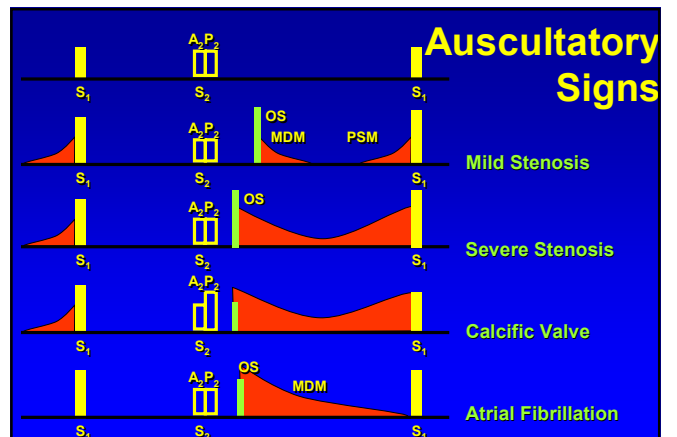
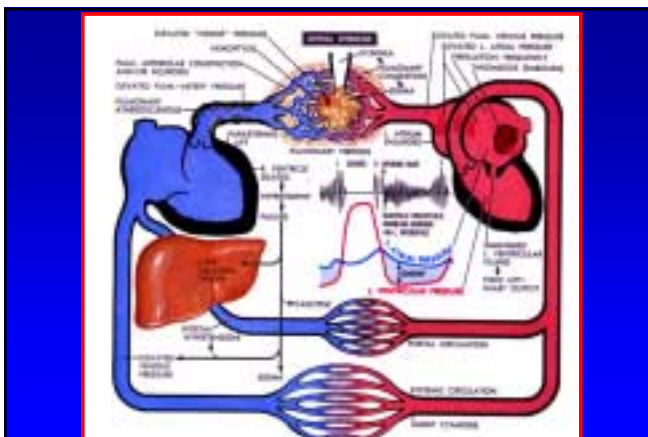
Mitral stenosis

1. Opening snap
2. Mid-diastolic murmur
3. Presystolic accentuation
4. Loud first heart sound



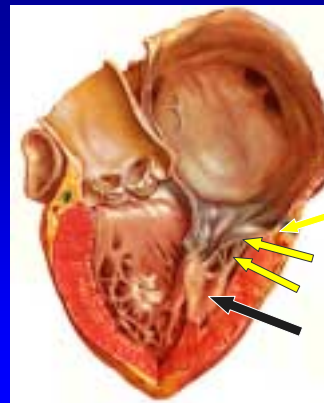
Mitral stenosis

- Ring
- Cusps
- Chordae
- Papillary muscles



תמונה מס' 6 מראה:

- מה אינו נכון?
 - הצרות המסתם הדו-צניפית - הפסקה בין איוושה אמצע דיאסטולית ופרי סיסטולית, מראה שההצרות קלה מאד.
 - העדרות של צליל פתיחת המסתם מראה מסתם מסויד.
 - המרחק בין הקול השני וצליל פתיחת המסתם מתערך עם חומרת ההצרות.
 - עוצמת הקול השני (חלק הריאתי) מגדיר את החומרה של יתר לחץ דם ריאתי וכן חומרת הצרות המסתם



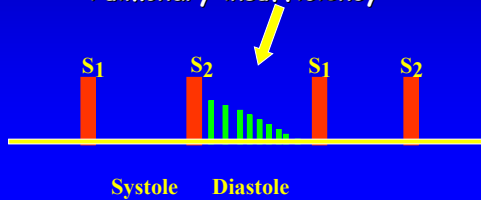
Mitral stenosis

- Ring
- Cusps
- Chordae
- Papillary muscles

Cardiac Examination: Auscultation

Murmurs:

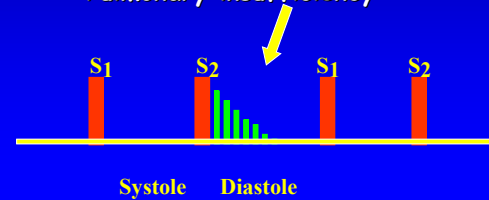
- Early diastolic
 - Aortic insufficiency - mild, severe
 - Pulmonary insufficiency



Cardiac Examination: Auscultation

Murmurs:

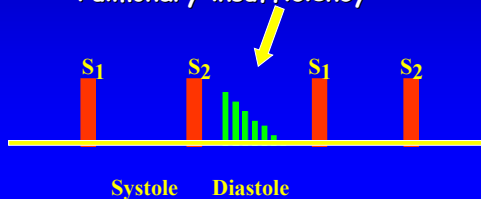
- Early diastolic
 - Aortic insufficiency
 - Pulmonary insufficiency



Cardiac Examination: Auscultation

Murmurs:

- Early diastolic
 - Aortic insufficiency
 - Pulmonary insufficiency



Cardiac Examination: Auscultation

Special physiological maneuvers:

- Squatting -
 - venous return \uparrow , vascular resistance \uparrow - LV volume \uparrow
 - Murmurs of MVP \downarrow , HOCM \downarrow , AS \uparrow
- Valsalva, Standing
 - The opposite effect
- Inspiration
 - increase in right sided flow and event
 - decrease in left sided flow and events

Cardiac Examination: Auscultation

Murmurs:

- Continuous

- Patent ductus arteriosus
- Aortopulmonary window
- Arterio-venous fistula
- Ruptured sinus of Valsalva

