ASSESSING HEART SOUNDS: A LOST ART?

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HOW CONFIDENT ARE YOU IN YOUR ABILITY TO …

- Ability to pick up a murmur?
- Distinguish an S_3 from an S_4 gallop?
- Identify a pericardial rub?

- Understand the pathophysiology behind an abnormal heart sound?

CASE #1 CHEST PAIN CHARLIE

- 56-year-old man presents with chest pain and shortness of breath.
- Symptoms began 4 hours prior to arrival No precipitating event
- Rates pain 7/10, describes as sharp, it's hard to get a full deep breath
- No improvement with 400 mg ibuprofen, most comfortable sitting upright

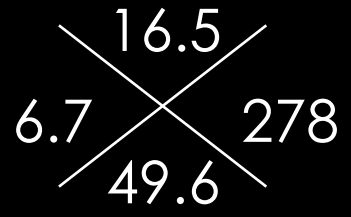
- PMH: T2DM, HTN, R ACL repair
- Meds: Metformin, Lisinopril, acetaminophen or ibuprofen PRN
- Allergies: NKDA
- Family Hx: Father- HTN, DM, MI age 55
- Social Hx: Nonsmoker, exercises 3 x week at the gym

PHYSICAL EXAM

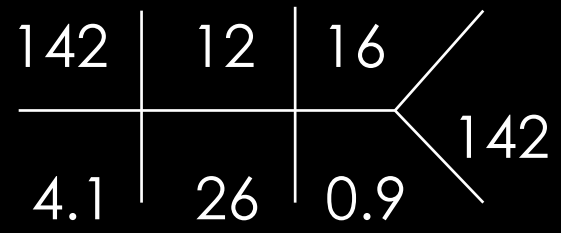
- Vitals: T 98.7 P 98 regular R 18 BP 142/78 SpO2 99% on RA
- General: Appears anxious, skin warm, pink & dry
- Head & Neck: PERL, face symmetrical, no JVD
- Resp: Chest wall intact, symmetrical excursion, nontender to palpation, Lungs CTA, but diminished in bases
- CV: Heart sounds RRR with harsh murmur, peripheral pulses symmetrical, no edema, no calf tenderness, BP symmetrical Right 142/78 Left 144/80
- Abd: Soft, non-tender, active bowel tones, no organomegaly or masses
- Neuro: Alert & oriented, PERL, motor & sensory intact, GCS 15

DIAGNOSTICS

- CBC



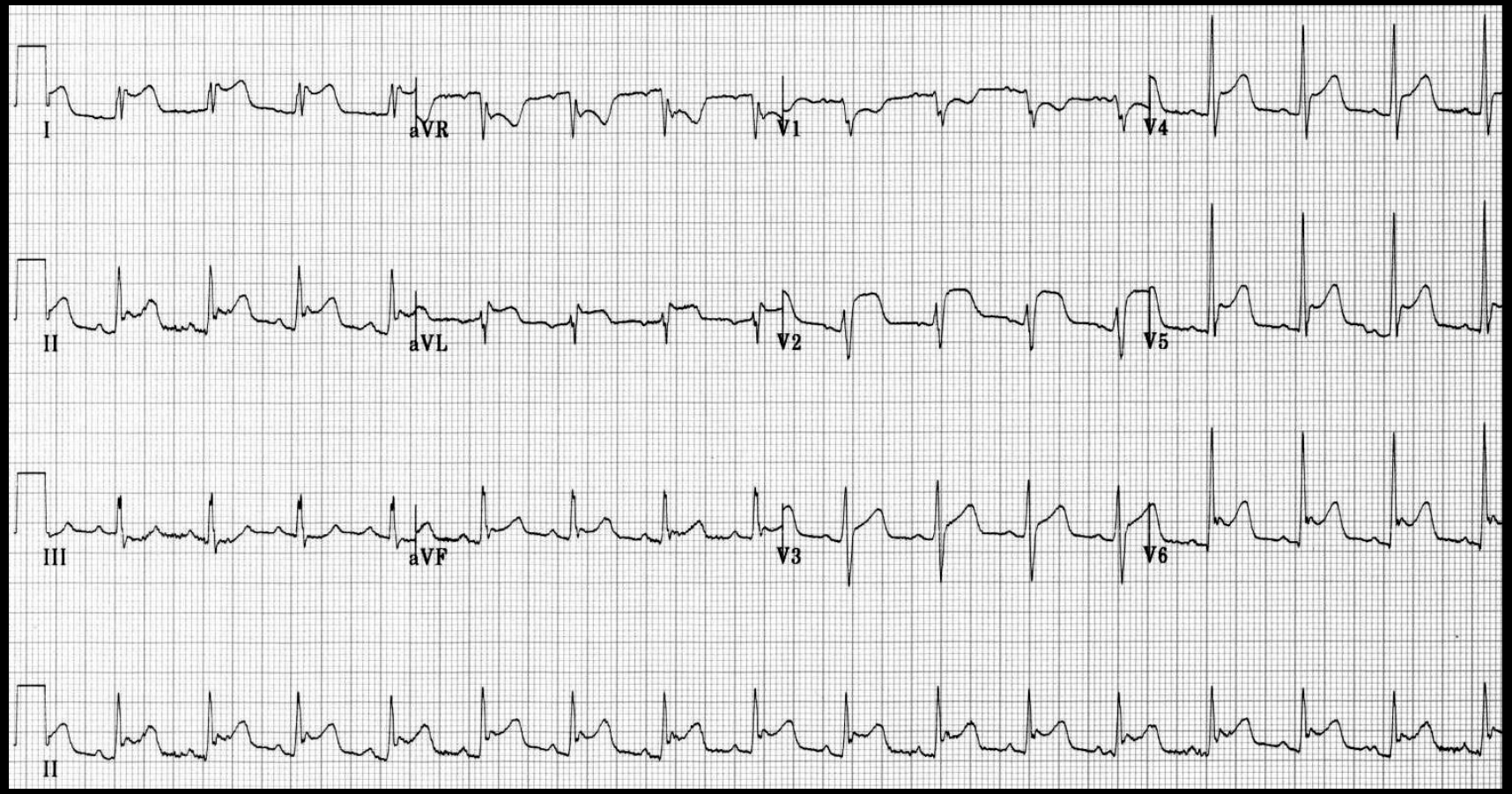
BMP



- Cardiac Troponin I 0.06 H (0-0.04)
- C-reactive protein (CRP) 7 H (< 5 mg/L)

12 LEAD ECG

- Sinus rate 100
- Normal intervals
- No BBB
- No chamber enlargement
- QRS Axis normal
- ST elevation in II, II & AVF, V2-V6, and I & AVL



CHEST RADIOGRAPH

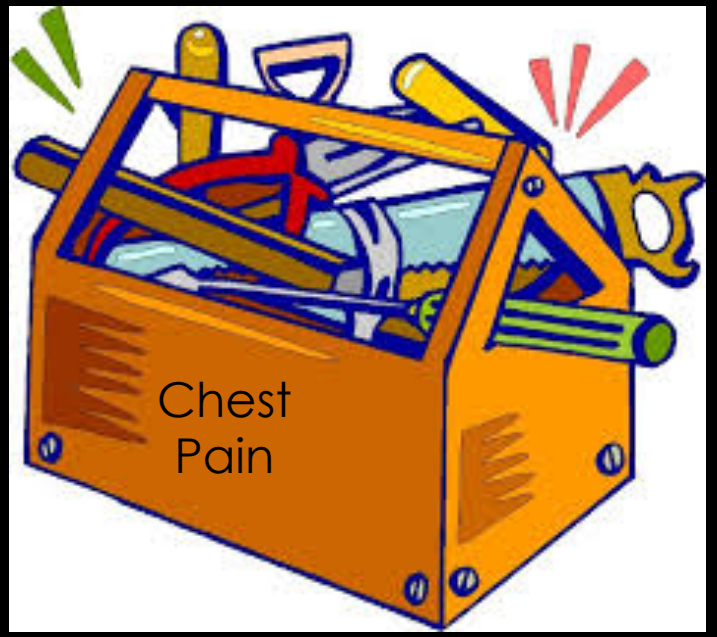
Interpretation:
Normal

Rule out:

Aortic dissection
Pneumothorax

WHAT DO YOU SUSPECT?

- A) STEMI
- B) Pulmonary Embolism
- C) Pericarditis
- D) Aortic Stenosis
- E) Cardiomyopathy



CARDIAC TROPONIN ELEVATION

- Acute MI (STEMI & NSTEMI)
- Cardiac Inflammation
  - Myocarditis
  - Endocarditis
  - Pericarditis
- Cardiomyopathy
  - Apical ballooning syndrome
- Heart failure
- LV hypertrophy
- Acute aortic dissection
- Acute Pulmonary Embolism
- ARDS
- Sepsis

CAUSES OF ST ELEVATION

- STEMI
- Prinzmetal angina
- Left Bundle Branch Block
- Early repolarization
- Acute pericarditis
- Brugada Syndrome
- LV Hypertrophy
- Left ventricular aneurysm
- Hyperkalemia
- Hypothermia

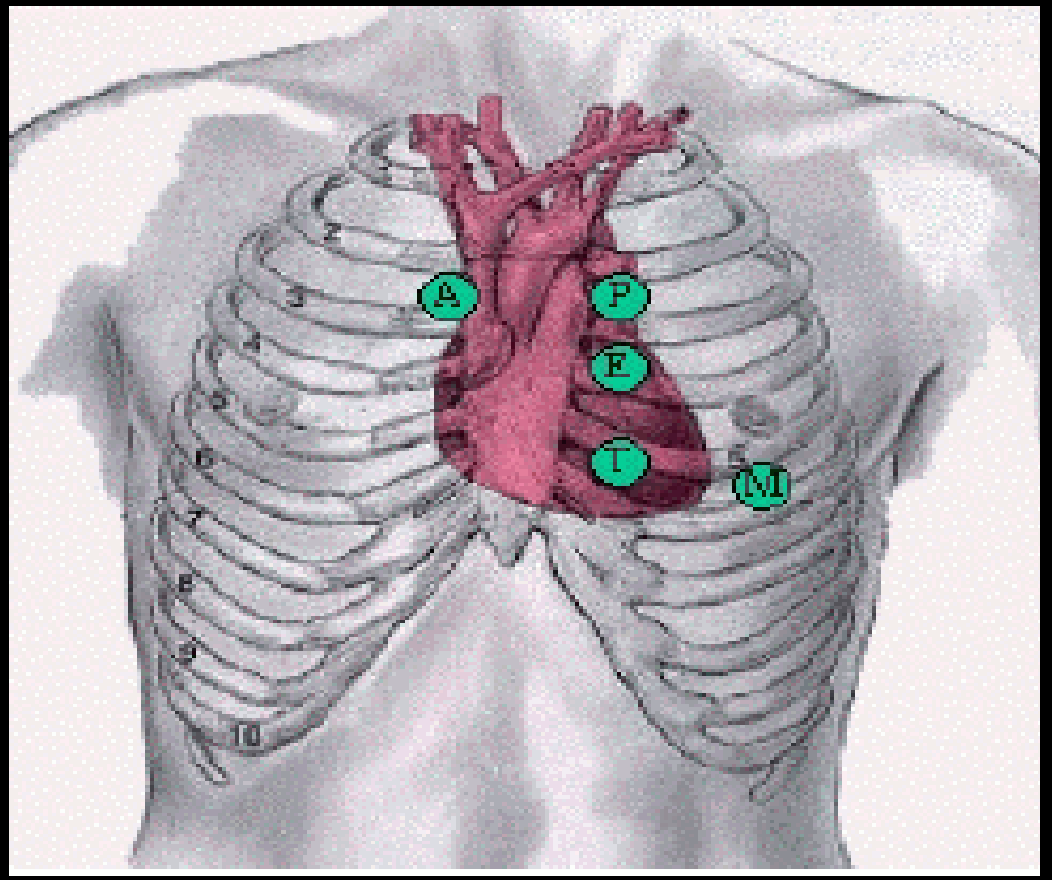
WHAT ABOUT THAT MURMUR?

Cardiac Murmurs caused by turbulent blood flow

- Increased rate of flow (pregnancy, fever)
- Stenosis
- Regurgitation or Insufficiency
- Flow into dilated chamber

CARDIAC AUSCULTATION SITES

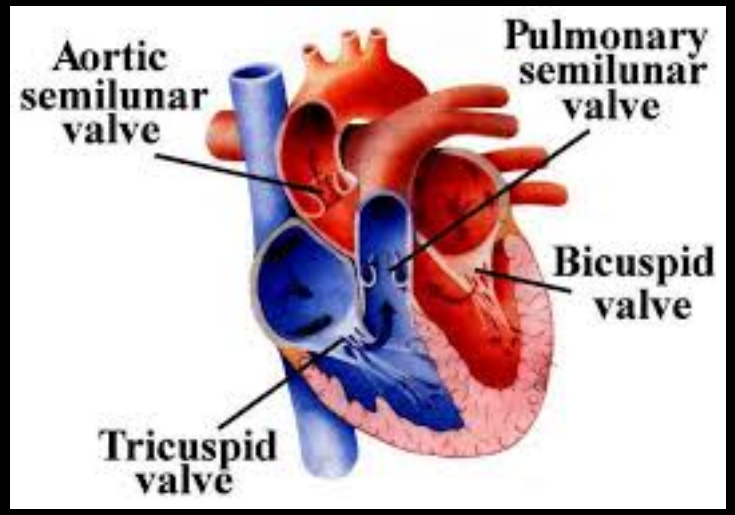
- **Aortic**
  - Right 2nd Intercostal space
- **Pulmonic**
  - Left 2nd Intercostal space
- **Tricuspid**
  - Lower left sternal border
- **Mitral**
  - 5th intercostal space midclavicular line

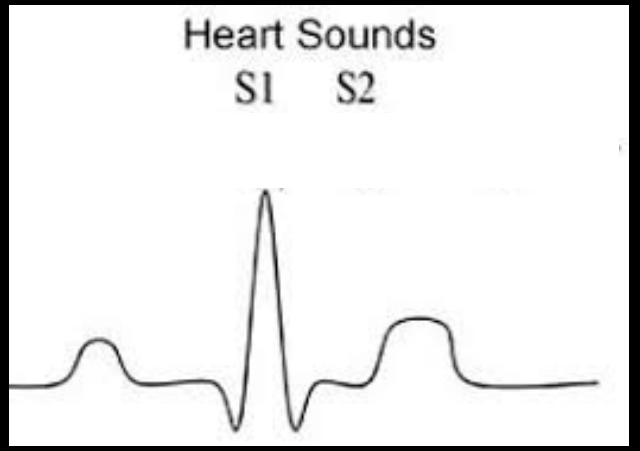


NORMAL HEART SOUNDS

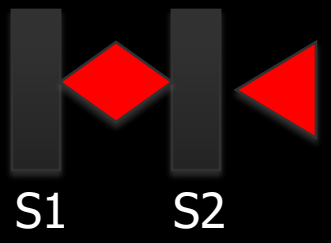
- **S1 "Lubb"**
- Closure of mitral & tricuspid valves
- Onset of ventricular systole
- Occurs during QRS complex

- **S2 "Dubb"**
- Closure of aortic and pulmonic valves
- Onset of ventricular diastole
- Occurs at beginning of T wave

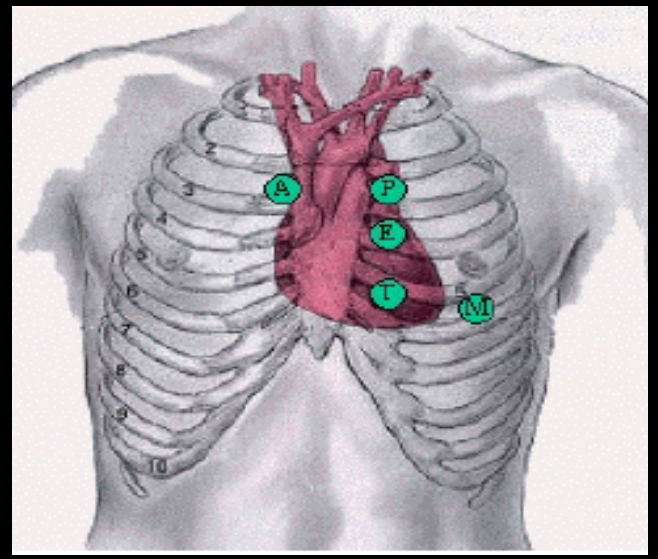




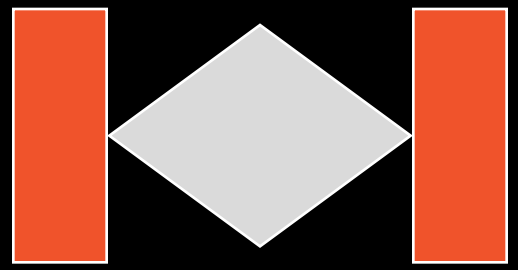
ASSESSMENT OF MURMURS



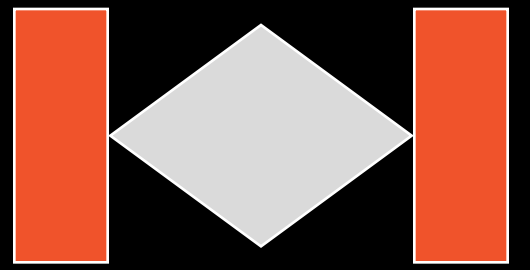
- Timing*
  - Systolic or Diastolic
- Location*
  - Site heard best
- Radiation
  - Axilla (Mitral Regurgitation)
  - Carotids (Aortic Stenosis)
- Pitch: High, low or medium
- Quality: Description of murmur
- Intensity; Graded 1-6 using Levine Scale



TIMING OF MURMUR



lub whoosh dub



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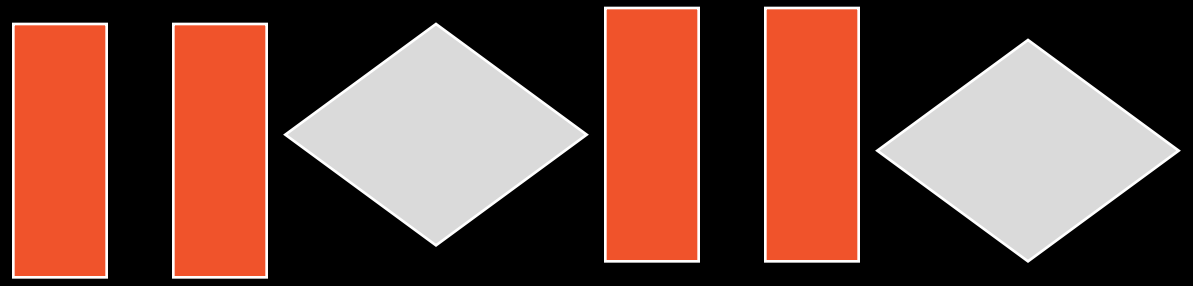
SYSTOLIC

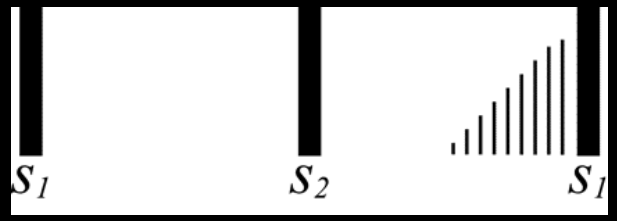


lub dub whoosh lub dub whoosh

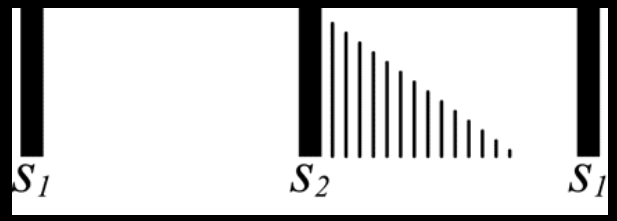
DIASTOLIC

SHAPE OR CONFIGURATION

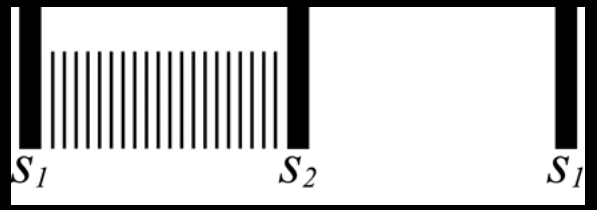
- Crescendo



- Decrescendo

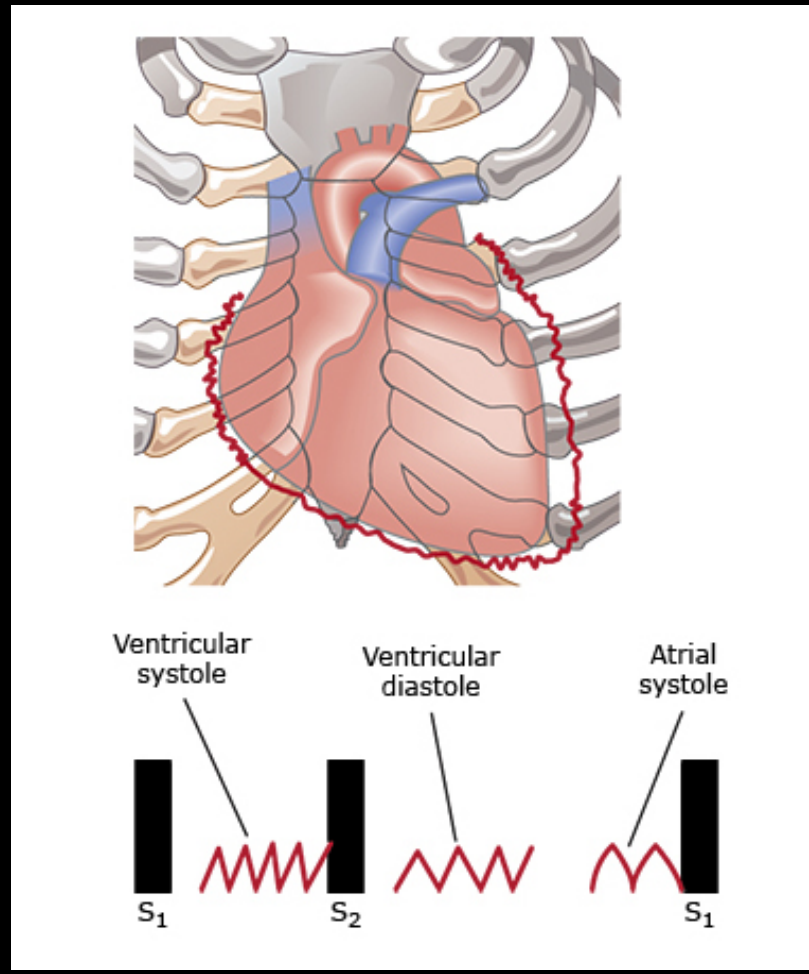


- Plateau shaped "Holosystolic"



PERICARDIAL RUB

- Inflammation of pericardium, may be associated with effusion
- Causes:
  - Pericarditis
  - Recent cardiac surgery
  - Myocardial infarction
  - Uremia
- Two or three components Systole & Diastole/Atrial
- Heard best:
  - Diaphragm at LLSB
  - Upright, leaning forward, on end expiration

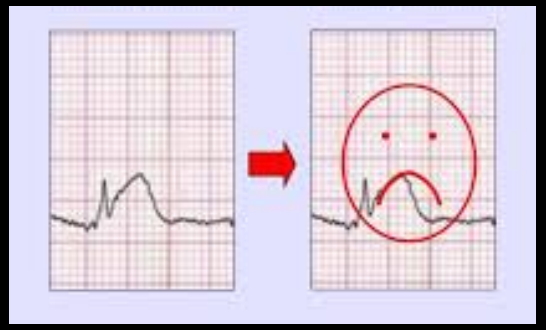


MURMUR VS. RUB

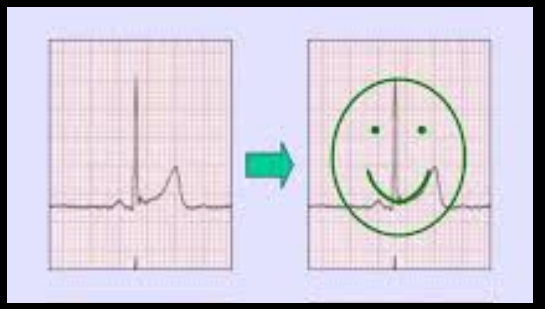
- Murmur
  - Caused by turbulent blood flow
    - Stenosis, regurgitation (insufficiency)
    - Abnormal flow, increased flow
  - One component
    - May increase (crescendo)
    - Decrease(decrescendo)

- Pericardial Rub
  - Caused by inflammation of pericardial lining
  - Associated with cardiac contraction
  - Three components (atrial contraction, ventricular systole and diastole)
  - Two components (ventricular systole & diastole)
  - Heard best with diaphragm, sitting upright, leaning forward

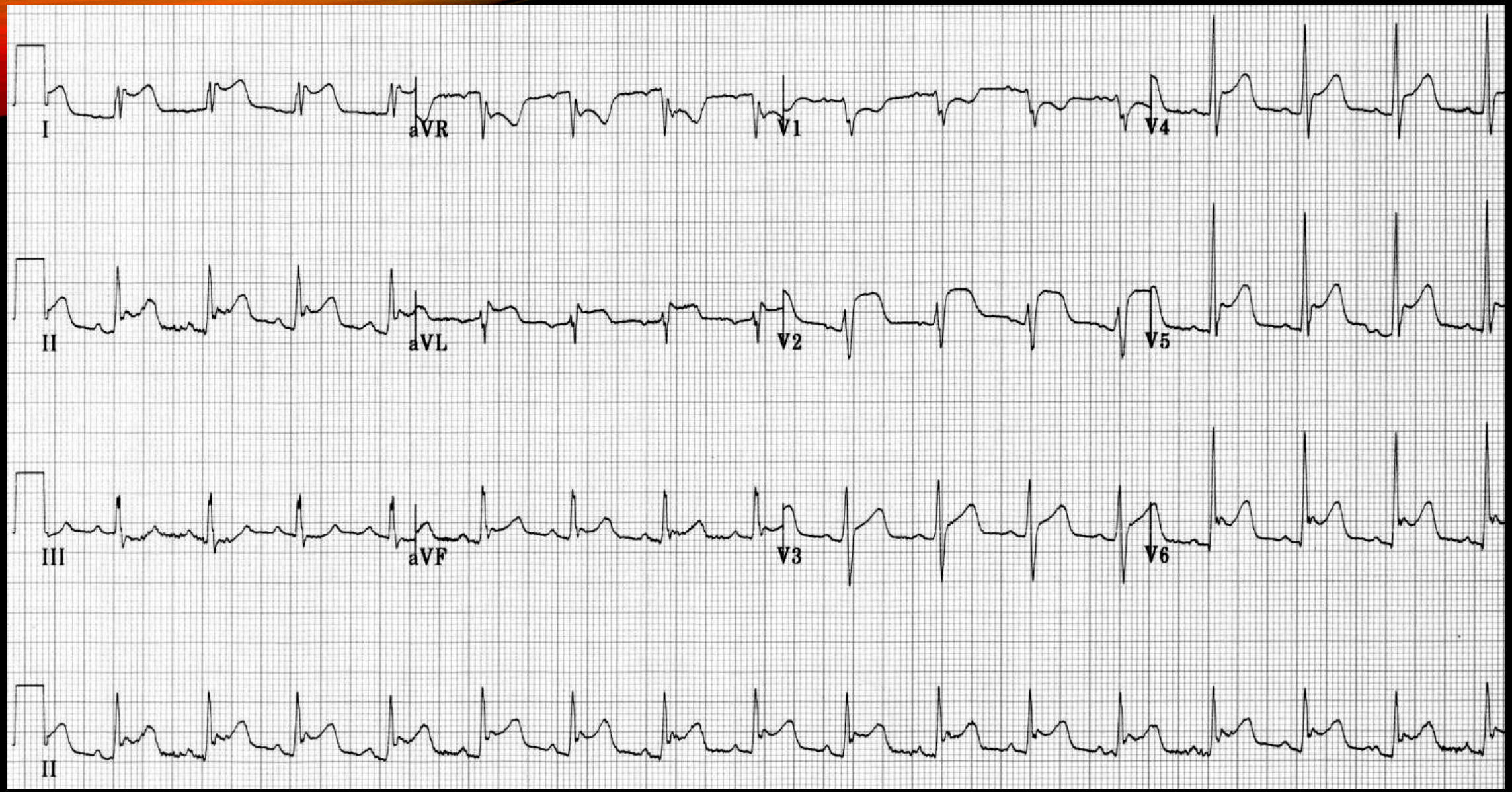
ECG CHANGES



- **STEMI**
- ST Elevation
  - Convex
  - Localized
- Reciprocal changes
- Pathological Q waves



- **Pericarditis**
- ST Elevation
  - J-Point elevation
  - Concave
  - Diffuse (all leads except aVR & V1)
  - Rarely exceeds 5 mm
  - No reciprocal changes
- Upright T waves
- PR segment depression all leads (except aVR and V1)


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

PERICARDITIS

- Chest pain
  - Typically sharp and pleuritic
  - Positional, improved by sitting up and leaning forward
- ●Pericardial friction rub
  - Superficial ,scratchy or squeaking sound
  - Heard best with diaphragm, along left sternal border
- ECG Changes
  - Concave ST segment elevation
  - PR segment depression

CASE #2 SHORT OF BREATH SAM

- 62-year-old man presents with increasing shortness of breath and orthopnea x 2 days. Sleeping in LazyBoy recliner
- Significant edema, unable to wear pants or shoes, wearing sweats & slippers
- PMH: Hypertension, COPD
- Social: Previous smoker, quit 2 years ago, denies IV drug use
- Meds: Lisinopril, HCTZ, Advair and Spiriva inhalers
- NKDA

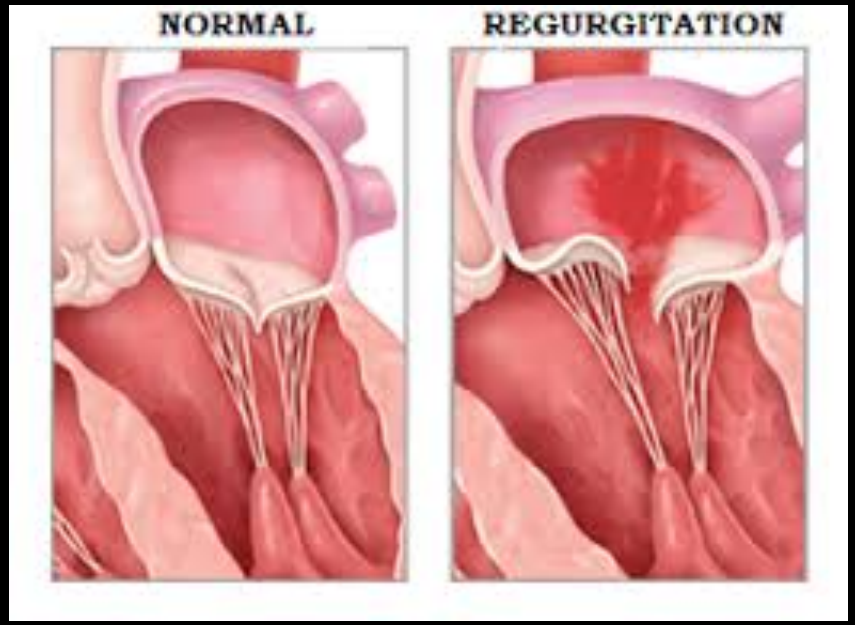
- T 98.5 P 88 R 24 BP 102/88 SpO2 90% on room air 93% on 4 L nasal cannula

PHYSICAL EXAM

- General: Appears fatigued, mild respiratory distress
- Neuro: Alert & oriented, PERL, no motor/sensory deficits
- Head & neck: Thyroid no enlargement, no swelling of lips or tongue
- CV: Sinus rhythm, JVD, audible early systolic murmur heard best at apex, 4+ peripheral edema, unable to palpate peripheral pulses, cap refill delayed
- Respiratory: HOB elevated 45 degrees, increased work of breathing, RR 24, no audible stridor or wheezes, but hear crackles throughout lungs
- Abdomen: Distended, unable to palpate organomegaly or masses

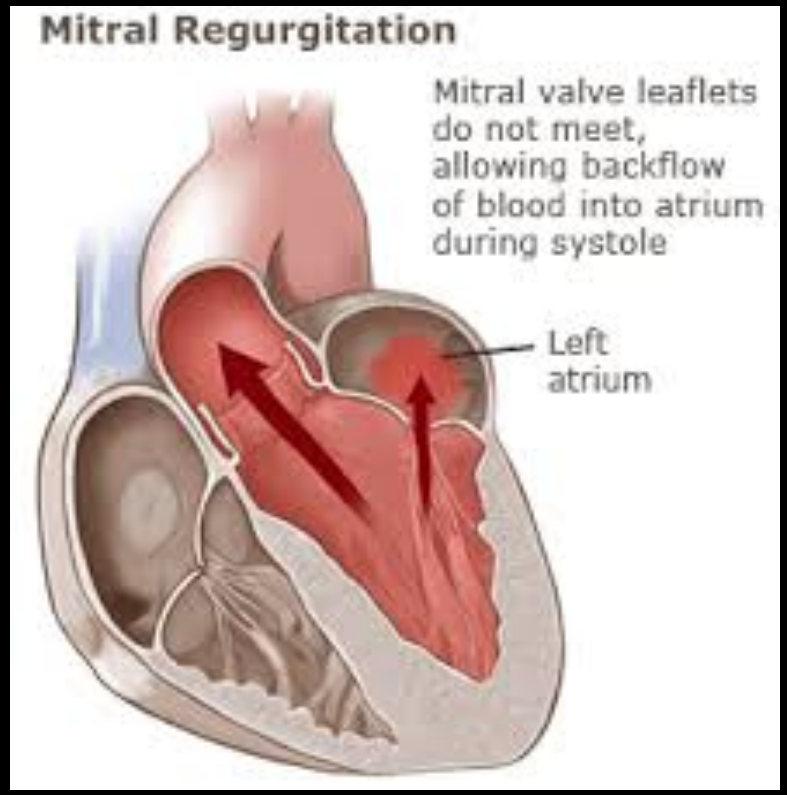
WHAT DO YOU THINK IS GOING ON?

- COPD exacerbation/pneumonia
- Myxedema /severe hypothyroidism
- Angioedema, reaction to lisinopril
- Heart failure due to ventricular septal defect
- Heart Failure due to acute mitral regurgitation



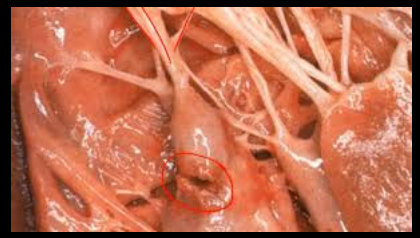
CAUSES OF MITRAL REGURGITATION

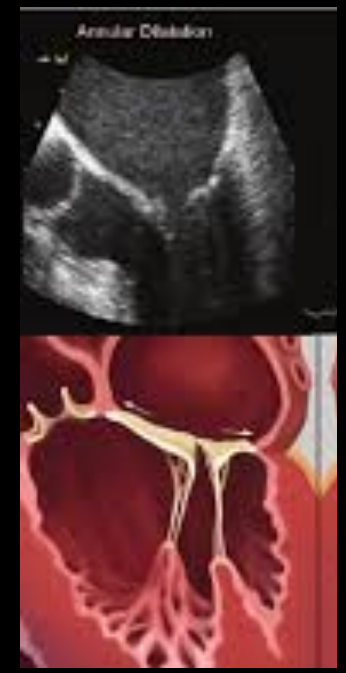
- Ischemic
  - Acute inferior MI
  - Papillary muscle rupture/dysfunction
- Non-ischemic
  - Rheumatic, associated with mitral stenosis
  - Endocarditis
  - Myocarditis
  - Dilated cardiomyopathy
  - LV enlargement stretching of MV annulus
  - Blunt chest wall trauma



MITRAL REGURGITATION

- Papillary muscle rupture/dysfunction
- LV Enlargement and dilation of MV annulus
- Rheumatic or endocarditis



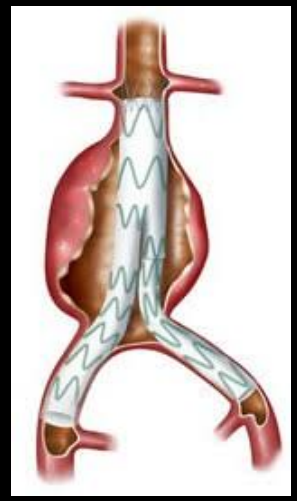


DISCUSSION CASE #2

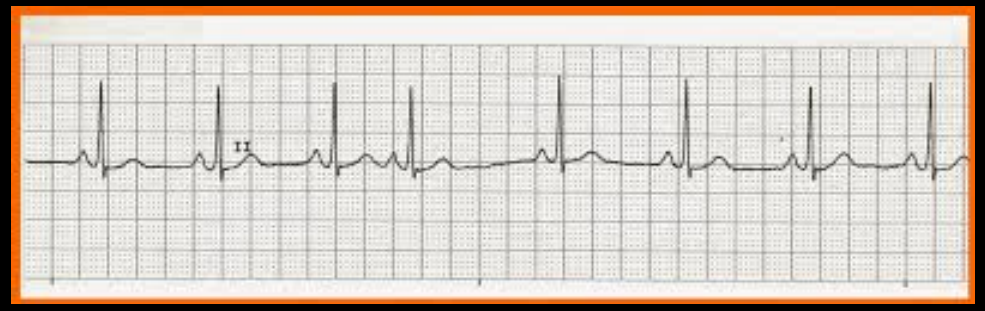
- Murmur was key to diagnosis
- Identified Mitral Regurgitation as underlying problem
- Now need to find out the cause of mitral regurg
  - Rule out ACS (ECG, chest x-ray, cardiac markers)
  - Echocardiogram
  - History of murmur?
- Treatment:
  Afterload reduction
  - Nitroprusside
  - Diuretics
  - Intra-aortic balloon pump

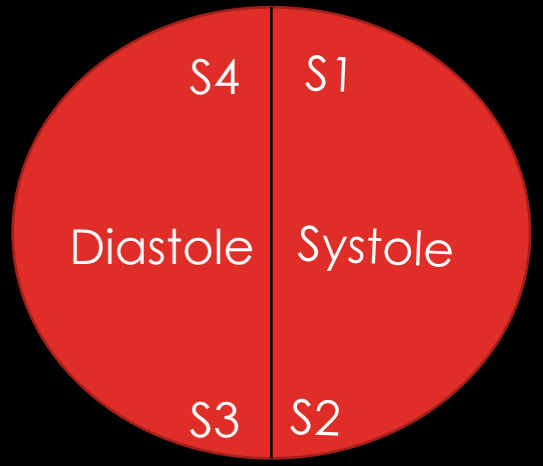
CASE #3 POST-OP PAULA

- 65-year-old female 1-day post op endovascular AAA repair
- Stable, however, on your routine assessment you note:
- Rhythm sinus with occasional to frequent PACs
- An extra heart sound, occurs immediately before S_1



- You suspect…
  A) a spilt S1
  B) a split S2
  C) S3 gallop
  D) S4 gallop



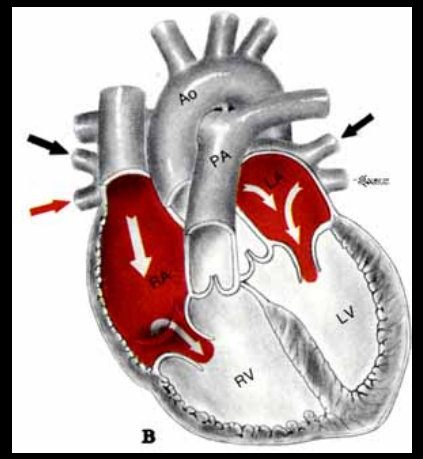


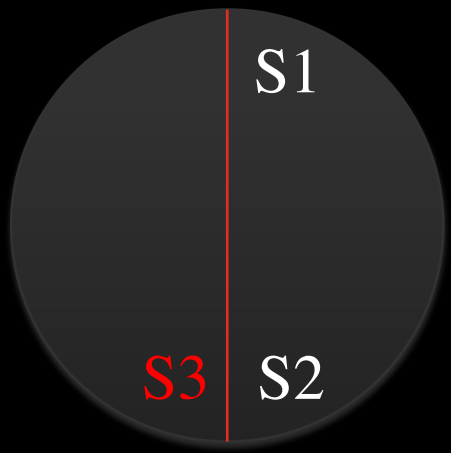
S_3 VENTRICULAR GALLOP

- Heard in **early** diastole, Immediately after S2
- **Passive** ventricular filling phase
- Very compliant ventricle

- Causes:
  - Heart failure, systolic
  - ACS
  - Cardiomyopathy, dilated

- Heard best with bell, left lateral position
  - Apex if left-sided origin
  - L sternal border if right-sided origin





Ken-tuck-Y

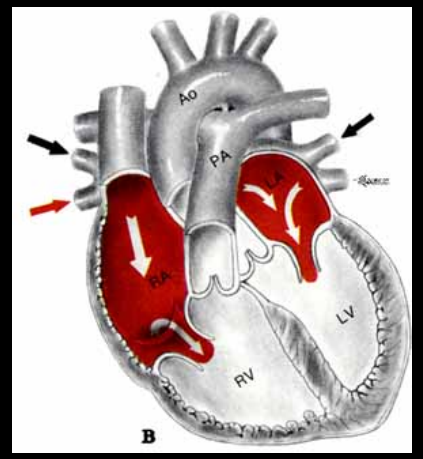
S_1 S_2 S_3

S_4 ATRIAL GALLOP

- Heard in **late** diastole, Immediately before S1
- **Active** ventricular filling phase
- Noncompliant ventricle

- Causes:
  - Heart failure, diastolic
  - ACS, ischemia
  - Cardiomyopathy, hypertrophic or restrictive
  - Hypertension
  - LVH

- Heard best with bell, left lateral position
  - Apex if left-sided origin
  - L sternal border if right-sided origin



TEN-nes –see
S_4 S_1 S_2

BACK TO OUR PATIENT

- You note a change in her rhythm

- Heart rate has increased to 120-130s and is now very irregular
- SpO2 has decreased to low 90's and you heard crackles in her bases
- Heart tones are irregularly irregular, and you no longer hear the extra sound Why not?
- How does this rhythm change affect her cardiac output?

SUMMARY

- Cardiac auscultation, like most skills, requires practice.
- When you hear an abnormal sound, consider the underlying pathophysiology.
- Heart sounds can provide essential clues to the underlying diseases processes.

QUESTIONS & COMMENTS

HEART SOUNDS WEBSITE

http-//depts.washington.#5C1844

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