High Yield Cardio for Step 1/2

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As I am sure you are well aware...

- They love making you think during these tests
  - You may know the murmur but they want to know if you can take it a few steps further
  - Seeing an EKG or having to listen to a murmur can make you stress out because it throws you off
    - Our goal is to help you not get thrown off by these cardio questions

- Challenge yourself to think of ways to integrate the information
  - Could easily ask about genetics or embryology off murmur
  - Also a lot of high yield infections that mess with your heart-rubella, GAS
Murmur Questions

• Text descriptions
  • Megri’s method will save you valuable time
• Audio questions
  • Check for radiation of the murmur
  • Clinical correlation to vignette-old lady with syncope with a murmur that radiates to the carotids will be AS 99% of the time
Murmurs

• If it is a text question-go to the description of the murmur and start eliminating (Megri’s Method)
  • Systolic
    • ASS (Aortic stenosis, pulmonic stenosis, tricuspid regurg, mitral regurg)
  • Diastolic
    • Aortic regurg, pulmonic regurg, tricuspid stenosis, mitral stenosis
  • Holosystolic
    • VSD, tricuspid and mitral regurg

• If you get in trouble-try to think about the murmur relative to the cardiac cycle
  • Murmurs-think of as feed forward issues or backflow issues
    • Feed forward-from valves that should be open but are not good at opening because they are stenosed
    • Backflow-valves that should be closed that are allowing backflow
    • Systole-open A/P, closed M/T
    • Diastole-open M/T, closed A/P
Systolic vs. Diastolic Murmurs

- In real life, being able to feel a radial pulse makes it easier to distinguish between systolic and diastolic murmurs
  - If you are unsure while you are seeing a patient in the clinic, feel for a pulse and the bounding corresponds to systole
- Unfortunately, USMLE has to use weird animations and sound clips
- Try tapping out the lub-dub and then using that to determine if it is systolic (between the lub and dub) or diastolic (between the dub and lub)
  - Just knowing that information can help you narrow it down
- Also, listening for the harsher sound can help you determine the murmur
  - Close your eyes and listen for whether it is sloshy then distinct or distinct then sloshy
Aortic Stenosis-crescendo decrescendo systolic murmur, loudest at base, radiates to carotids

• Radiates to carotids
• Older patient w/ syncope, angina, dyspnea
• Pathology-calcification, could be secondary to rheumatic heart (MR to AS)
• Bicuspid aortic valve calcifies earlier
  • High association with Turner
• Just for kicks and giggles-LVH 2/2 aortic stenosis
  • Septal leads will show crazy amplitude of QRS
Aortic Stenosis
Mitral Regurg

• Description-holosystolic helps narrow it down
• Mitral radiates to axilla
• Can be from infection-early or late manifestation of rheumatic fever (classically earlier manifestation of RF is MR)
• Can occur in the setting of IE/MI-chordae rupture leading to regurg or papillary muscle (chordae more suscceptable to vegetation and papillary muscle rupture 2/2 ischemia post MI)
• Because of the backflow you will get enlargement of the LA and LV
• Just for kicks and giggles-P wave abnormalities in EKG (looks like m)
  • Can also have splayed carina on x-ray because LA is closest to carina
  • LAE can also cause hoarseness (L recurrent laryngeal nerve) and dysphagia (esophagus compression)
Mitral Regurgitation
Mitral Regurg

- More specific sign of MR on CXR is the “double density” sign - I just learned this so this is really just for kicks and giggles
- Normal right border on CXR is from RA
Tricuspid Regurg

- Essentially the same as MR
  - Less classical causes/associations
  - Different location
  - Does not radiate to the axilla
  - RVH and RAE
  - Louder with inspiration (like all R sided murmurs)
VSD

• Holosystolic (like MR/TR)
• Embryologically-most commonly occurs at the membranous portion
  • From growth of endocardial cushion
MVP

• Most frequently described as murmur in a click in a young female
• Myxomatous degeneration
• If symptomatic with heart palpitations-can treat with BB
• Late systolic with a click
• Infective endocarditis-degeneration predisposes to IE (most commonly associated with Strep Viridans because it frequently attacks damaged valves)
Aortic Regurg

- Early diastolic blowing murmur
- Head bobbing
- Bounding pulse felt in fingertips
- Widened pulse pressures
- Seen from endocarditis, aortic root dilation (syphilis, connective tissue disorders), bicuspid aortic valve
Mitral Stenosis

- Opening snap
- Radiates to axilla
- Seen in RF (RF murmurs are in alphabetical order MR early, MS late)
Patent Ductus Arteriosus

- In utero connection between pulmonary arteries and aorta is advantageous because your lungs aren’t useful
- Continuous machine
- Seen in congenital rubella
- When would the ductus be advantageous?
  - Cyanotic heart lesions-give PGE to keep it open
- Indomethacin can close the ductus-disadvantage to use in the world of obstetrics to slow down labor
But then they add movements

- Once again, they are trying to make you uncomfortable
- Only 2 murmurs do the opposite of the other
  - General rule-increasing preload should increase a murmur, increasing afterload should decrease a murmur
  - The two exceptions (MVP, HOCM) are going to be seen in young patients
- Aortic stenosis and HOCM sound pretty freaking similar
  - Aortic stenosis-older, calcified valve or bicuspid valve (most commonly associated with Turners), murmur will decrease with squat and increase with leg raise
  - HOCM-younger male athlete, easy way for them to tie in genetics or histo/physio (murmur will increase with valsalva and decrease with leg raise)
  - MVP is also systolic like AS and HOCM-distinguish with click
## Maneuvers

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<tr>
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<th>Venous Return / Preload</th>
<th>Afterload</th>
<th>Drugs</th>
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<tr>
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<td>Increase (Leg raise / Squat)</td>
<td>Decrease (Valsalva / Standing)</td>
<td>Increase (Handgrip)</td>
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<td>↓(AS)</td>
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TLDR Murmurs

• Description-ASS and work from there

• Listen for radiation-all of the murmurs below are systolic and will sound differently but if you start panicking with the sound quality-moving your stethoscope could save you
  • Radiation to carotid-AS
  • Radiation to axilla-mitral valve (MR)

• Maneuvers-only HOCM and MVP differ in the general rule that preload increases a murmur and afterload decreases a murmur
  • Increase preload by squatting or leg raise/decrease afterload hand grip
  • Decrease preload by standing up/valsalva
But what if they throw in an EKG-I failed the cardio exam and still don’t get them

• Remember-EKGs are measuring vectors based on particular lead placement
  • Heart should depolarize from R to L and top to bottom
    • Natural conduction system is the most efficient conduction system
      • If you have the current depolarizing but in a direction that the system isn’t made for-timing of a particular segment is going to be off
        • Wide QRS-WPW, LBBB, RBBB
  • Net current towards something gives an upward deflection, away gives a downward deflection
EKG

• Hard to know the basics because they seem so simple until you are put on the spot

• Try to understand rather than just memorize and recognize a pattern

• Dr. Petrany does a great job teaching a systematic way of going through EKGs-rate, rhythm, axis, PR, QRS, ST, QT
  • Admittedly lower yield for Step 1 but high yield for shelf exams and Step 2
  • Regardless of which field you go into-you WILL order an EKG on your patient at some point-so know how to read them
Back to Basics-lower yield for Step 1

• Rate 60-100, count off method (300, 150, 100, 75, 60)
  • If they give you a 12 lead with a rhythm strip-x6
Back to Basics-Axis
Back to Basics

- **Axis-normal from -30 to 90**
  - Remember that positive currents mean that the net depolarization is going towards that lead
  - Lead I lines up with 0 and aVF lines up with 90
    - If they are both positive you are between 0 and 90
    - If aVF is positive and I is negative you have RAD
    - If I is positive and aVF is negative, you are between 0 and -90
      - To determine if LAD or normal, look at II
      - If II is positive-NAD
      - If II is negative-LAD
PR Interval

- Atrial depolarization to ventricular depolarization
  - Tells you if the conduction from SA to AV node is working
- Shortened (<.2) in WPW because the Bundle of Kent depolarizes before the conduction from SA to AV occurs
- Prolonged (> .2) in AV Blocks
QRS

• Back to the rule that normal conduction is the fastest-if the QRS is prolonged that means that the normal conduction pathway is not working
• Recall that the heart depolarizes SA->AV->Bundle of His (RBB and LBB, LBB further splits into anterior and posterior fascicles->Purkinje)
• If the heart is using the normal conduction pathway, the QRS (ventricular depolarization) should be less than .12s
• If the heart cannot use that conduction pathway because there is a block or current is going the wrong direction, it will take >.12s
  • RBBB, LBBB, Anterior hemi-block, posterior hemi-block, pacemaker, WPW
**ST**

- ST segment will change as a reflection of ischemia and infarction
  - Can only be called if there are reciprocal changes
    - ST depression-ischemia
    - ST elevation-infarction
  - Occurs in group of leads
    - Inferior leads-II, III, aVF, **give fluids (not nitroglycerin) because problem is preload and vasodilation decreases preload**
    - Septal-V1-V2
    - Lateral-I, aVL
  - Diffuse STE seen in setting of pericarditis
    - NSAIDS and colchicine
ST

- Important to know groupings because they signify which artery is occluded
  - Nodes supplied by RCA
    - Can get HB from inferior MI
  - Dominance becomes important
    - MC PDA from RCA (R dominant)
    - PDA from LCX (L dominant)
AV Blocks

• Heart Block
  • 1st Degree is no big deal, just a long PR interval
  • 2nd Degree type 1-PR lengthens then drops
  • 2nd Degree type 2-drops a beat without lengthening
  • 3rd Degree-no association with P and QRS
    • Highest yield associations are with 3HB
      • Lyme disease, baby from mother with Lupus AC
    • Just for kicks and giggles-PE finding of 3HB is cannon a-waves
      • No association between cardiac cycle so you are shooting blood against a closed valve at times
AV Blocks
AV Blocks
Atrial Fibrillation

• Irregularly irregular
  • No p waves
  • Irregular RR intervals

• Risk factors—at the basic level is from AE
  • AE from HTN or CAD
  • Risk for stroke
    • Thrombus formation in the LA appendage
    • Rate or rhythm control and anti-coagulation
    • Cardioversion-TEE to ensure no thrombus in LA appendage

• MCC of new onset Afib is hyperthyroidism—reflexively check TSH/T4
Atrial flutter

• Consistent electrical circuit
• Sawtooth appearance
  • For kicks and giggles - direction of the sawtooth pattern dictates if it can be ablated (RA>LA, medical management of LA ectopic circuit)
• Consistent RR interval
• Treat with OAC, rate or rhythm control
Ventricular fibrillation

• Not using the right conduction pathway
• Wide QRS
• CPR and defibrillation
• This will kill ya
WPW

• Short PR and prolonged QRS
• Accessory pathway in Bundle of Kent
• Treat with procainamide (IA antiarrhythmic)
  • Possible drug side effect-lupus
**Pre-excitation**
- Short PR interval
- In this case the PR segment cannot be seen.

**Orthodromic AVRT**
- Normal QRS duration
- No delta wave
- Retrograde P-wave after QRS

**Antidromic AVRT**
- Wide QRS complex with delta wave
- P-wave rarely seen
- If P-wave visible, it is retrograde and occurs just before the QRS
Torsades

- Form of VTach that can quickly deteriorate into VFib
- Treatment-magnesium sulfate
- Can be caused by lots of drugs
  - Ondansetron
  - TCA-give sodium bicarb in TCA poisoning
  - Anti-arrhythmics
  - Antipsychotics
  - Antibiotics-macrolides, FQN
TLDR EKG

• Normal conduction is the most efficient
• ST elevation transmural, must be in group with reciprocal changes to call as STEMI
• A fib disorganized, no p waves
• A flutter organized into “sawtooth” pattern
• Torsades rotating vfib (wide QRS), high yield drug causes, give Mg
• WPW delta wave and long QRS (give procainamide)
• AV Blocks-First degree long (no treatment), Second degree Type 1 lengthening and drop, Second degree Type 2 drop, Third degree no relationship (Lupus AC, Lyme Dz)
Putting it all together

• A patient comes in with this EKG
Looks like a STEMI

• Which leads/which artery?
  • Septal leads-LAD

  • Well, a couple days later you listen to him and you hear a new holosystolic murmur
    • Can only be MR, TR, and VSD
What if they say that there is a step-up in O2 concentration?

• New VSD from loss of interventricular septum
Wigger’s Diagrams

Normal

- Ventricular pressure is the portion that moves the most
- Opening of valves depends on pressure changes
Systole (1 on the diagram)

- Think of these graphs in two ways
  - Pressure differences that are too great
    - Occurs with stenotic valves
  - Filling too quickly
    - Occurs with regurgitation

- In systolic portion-pressure from AS/PS, filling from MR/TR
Systole (1 on the diagram)
Systole

During ventricular ejection, LVP exceeds AP (gray area, pressure gradient generated by stenosis).

Abbreviations: LAP, left atrial pressure; LVP, left ventricular pressure; AP, aortic pressure.

During ventricular contraction (systole), the left ventricle ejects blood back into the left atrium as well as into the aorta, thereby increasing LAP, particularly the v-wave.

Abbreviations: LAP, left atrial pressure; LVP, left ventricular pressure; AP, aortic pressure.
Diastole (2 on the diagram)
Diastole

During ventricular filling (diastole), LAP exceeds LVP (gray area, pressure gradient generated by stenosis). Abbreviations: LAP, left atrial pressure; LVP, left ventricular pressure; AP, aortic pressure.

During ventricular relaxation, blood flows backwards from aorta into the ventricle. Aortic systolic pressure increases, aortic diastolic pressure decreases, and pulse pressure increases; LAP increase. Abbreviations: LAP, left atrial pressure; LVP, left ventricular pressure; AP, aortic pressure.
TLDR Wigger’s Diagram

• Pressure differences greater than expected from stenotic valves
  • Systolic-AS
  • Diastolic-MS
• Filling too quickly from regurgitation
  • Systolic-MR
  • Diastolic-AR
Good Luck!

Questions or comments:

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