CAD AND BEYOND….

Common cardiovascular impairments seen in underwriting

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Overview

- Community Screening tests
- Commonly seen tests for CAD
- Review of aortic root/ascending aorta anatomy
- What exactly is diastolic dysfunction on an echo?
- What's new?

Community Screening Tests…

- Asymptomatic community cardiovascular screenings
- Done for profit/cash pay
- Range from $99 - $150 and include:
  - Carotid artery screening ultrasound
  - PAD screening with ABI measurements
  - ABD Ao aneurysm screening with ultrasound
  - Atrial fib screening with a short ekg

Carotid Screening…

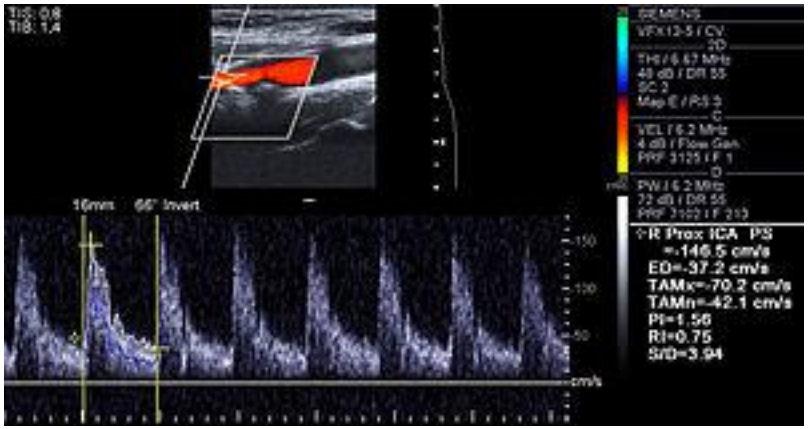


Image: En.Wikipedia.org

- Carotid Doppler US image with plaque showing < 70 % stenosis with velocities

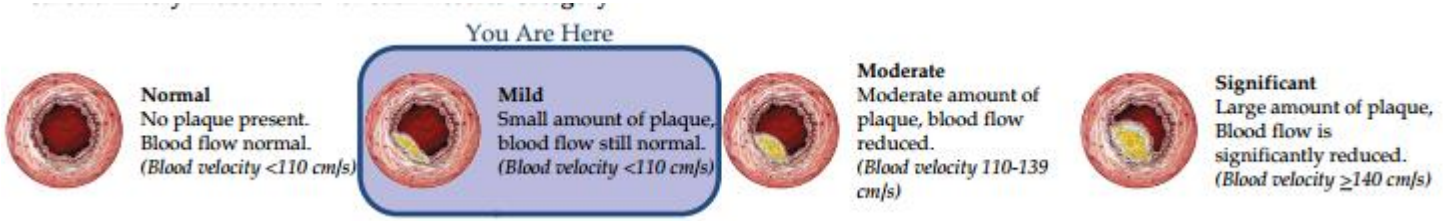
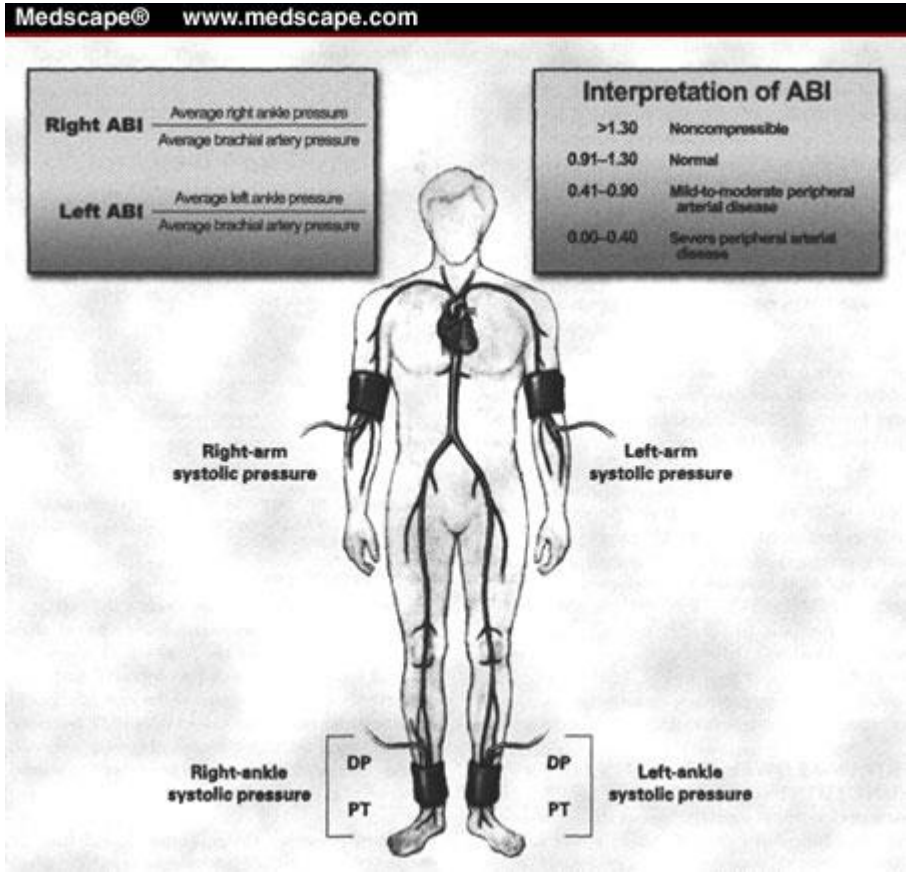


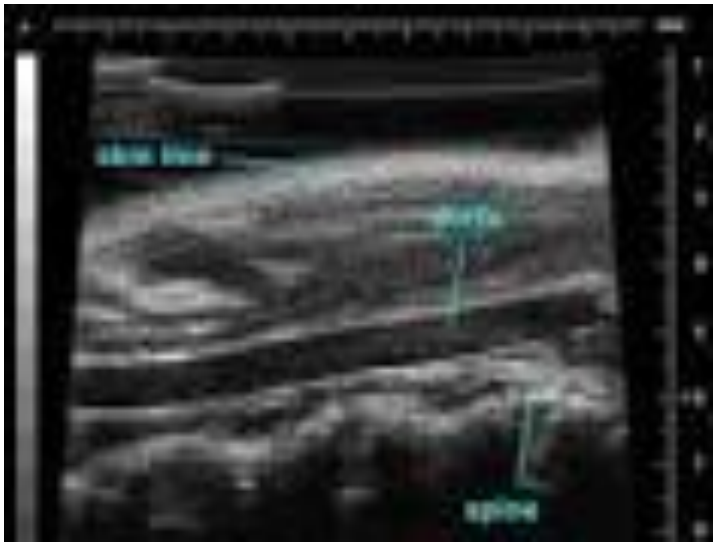
Image: Lifelinescreening.com

Peripheral Arterial Disease Screening…



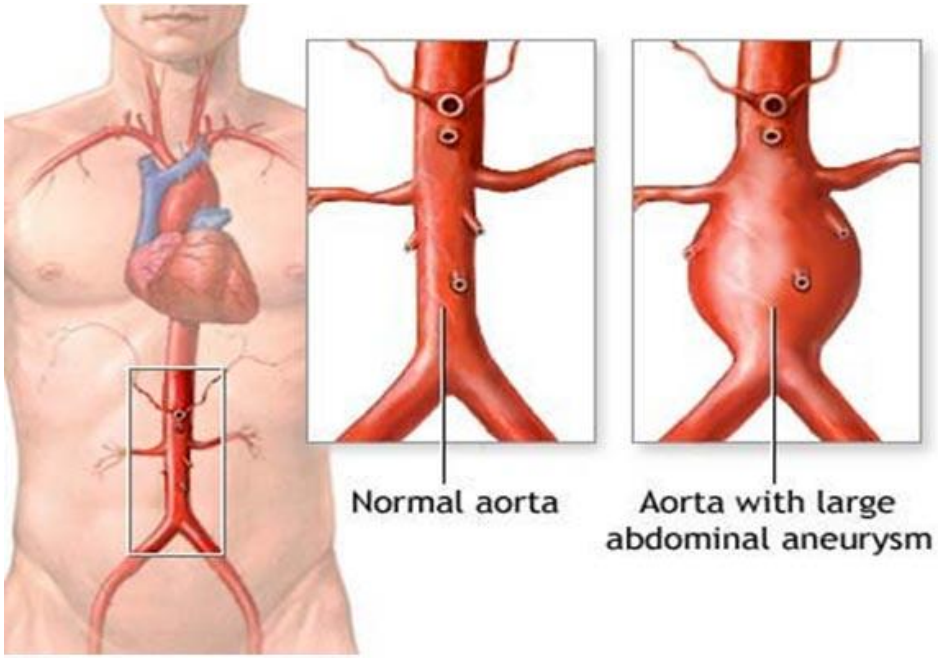
Abdominal Aortic Aneurysm Screening…

US image



Visual sonics.com

Anatomy



www.aci.health.nsw.gov.au

Clinical Testing for Coronary Artery Disease

Anatomic tests

Cardiac cath, CCTA, EBCT/CAC scoring

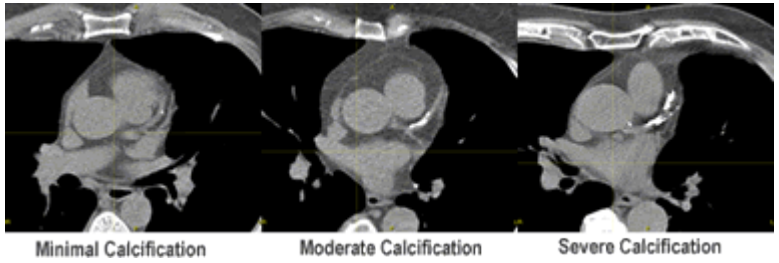
- Only show the anatomy without any info on the impact that a lesion has on the heart muscle

Functional tests

Stress testing, perfusion stress testing, stress echo, perfusion MRI

- Evaluate exercise tolerance
- Symptoms
- BP response to exercise
- Myocardial response to exercise

EBCT/Coronary Artery Calcium Scoring(CAC)



OC heartinstitute.com

CCTA/Cardiac CT Angiography

Image: www.mghradrounds.org

EBCT/CCTA

non-invasive

EBCT/ CAC scoring

- Often used for screening in asymptomatic individuals
- CT Scan without contrast that detects and quantifies calcified plaque in coronary arteries
- Provides a total calcium score (Agatston score)
- Not actually a clear image of the anatomy, more a score of amount of calcium present

CCTA

- Evaluates coronary arteries and cardiac anatomy
- Uses contrast dye combined with CT scan to detect both calcified and non-calcified plaque in the coronary arteries
- May also provide a total calcium score

CCTA sample report…

Preparation: Resting heart rate was 49 beats per minute. Immediately prior to the study 400 mgs of nitroglycerine was administered.
Technique: EKG gated non contrast images of the heart were obtained. Then, a timing bolus acquisition was performed at the level of the aortic root. Approx 20 cc of contrast and 20cc of normal saline were used for this. This was followed by post contrast CT coronary angiography acquisition after admin of 95cc of Omnipaque 350 and 40cc of normal saline. Cardiac 64 CT scanner was used for this exam.
Findings: Non-cardiac chest CT findings reported separately
Heart: The heart is structurally normal, no calcifications seen in the valves, no pericardial effusion.
CT Angiography of the Coronary Arteries:
RCA: Minimal soft plaque without evidence of significant stenosis
Left Main Coronary Artery: No evidence of stenosis or plaque in the left main.
Left anterior Descending Artery: Small focal soft plaque at the origin producing 5-15% stenosis
Circumflex: minimal soft plaque without significant stenosis in the mid portion.

Cardiac catheterization/coronary angiography

Invasive study

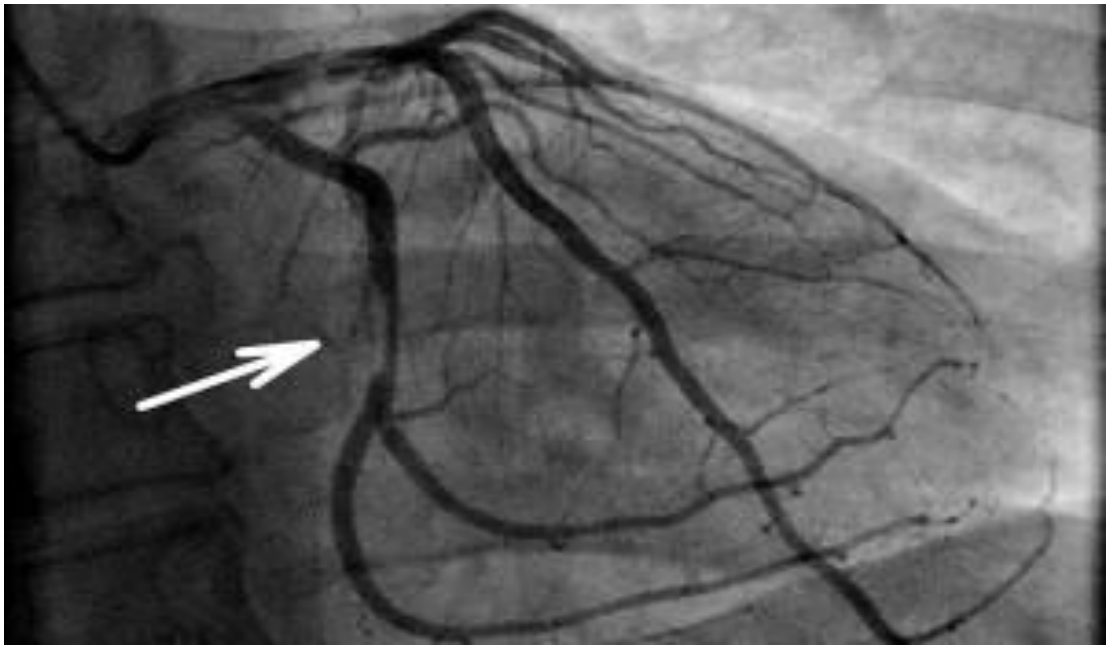


Image: www.nsccheart.com

Coronary Angiography Using Fractional Flow Reserve…

$$FFR = \frac{\text{Distal Coronary Pressure (Pd)}}{\text{Proximal Coronary Pressure (Pa)}}$$

(During Maximum Hyperemia)

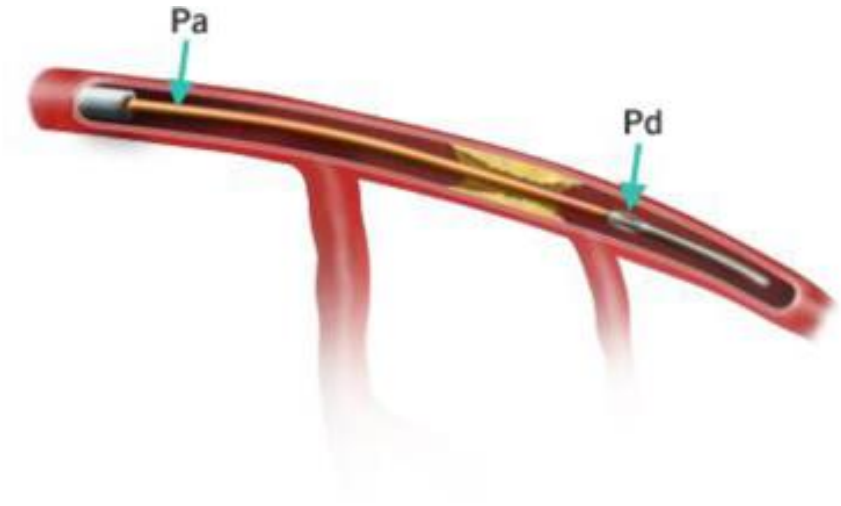
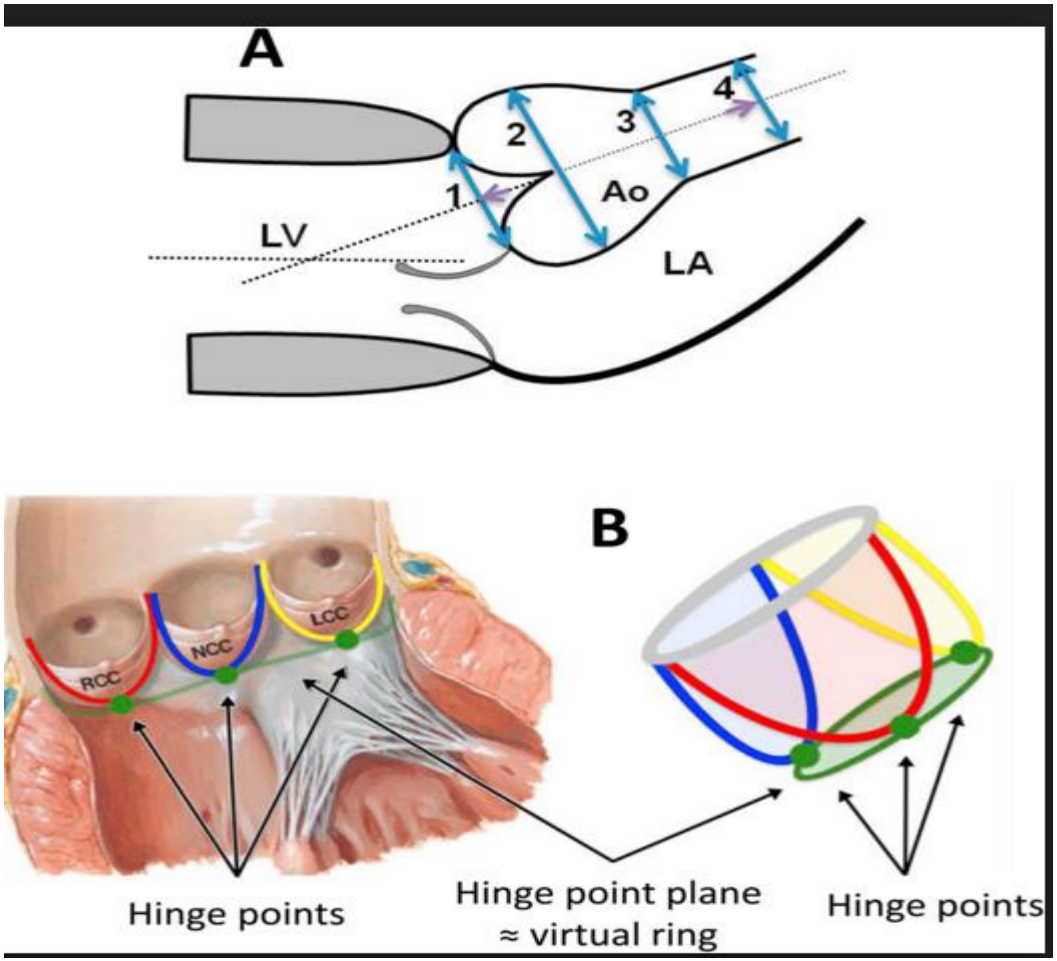


Image: www.pscch.med.sa

MOVING ON…….

Some review of basic aortic root/ascending aorta anatomy…



1. Valve annulus
2. Aortic sinuses
3. Sinotubular junction
4. Proximal ascending aorta

Image: oninejase.com

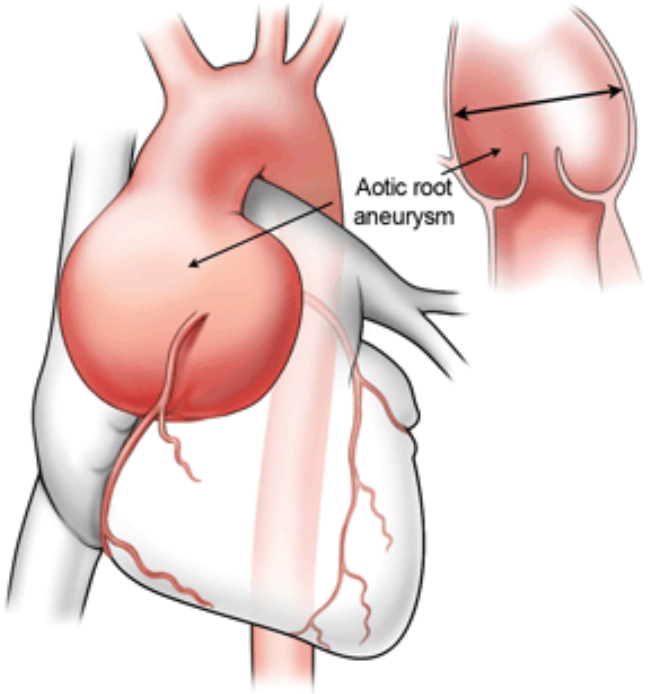


Image:Columbia surgery.org

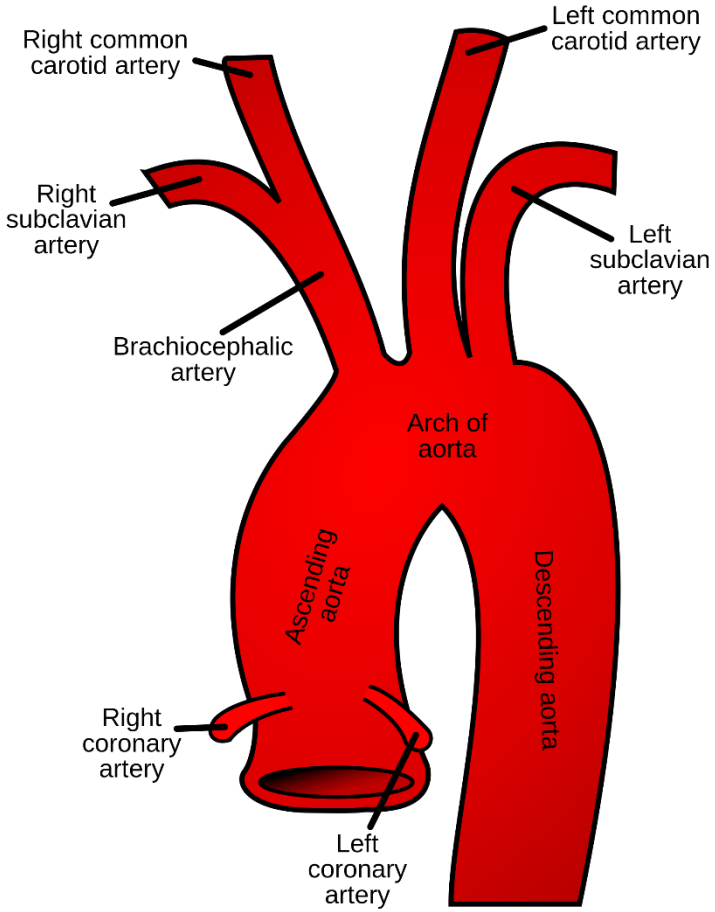


Image: en.Wikipedia.org

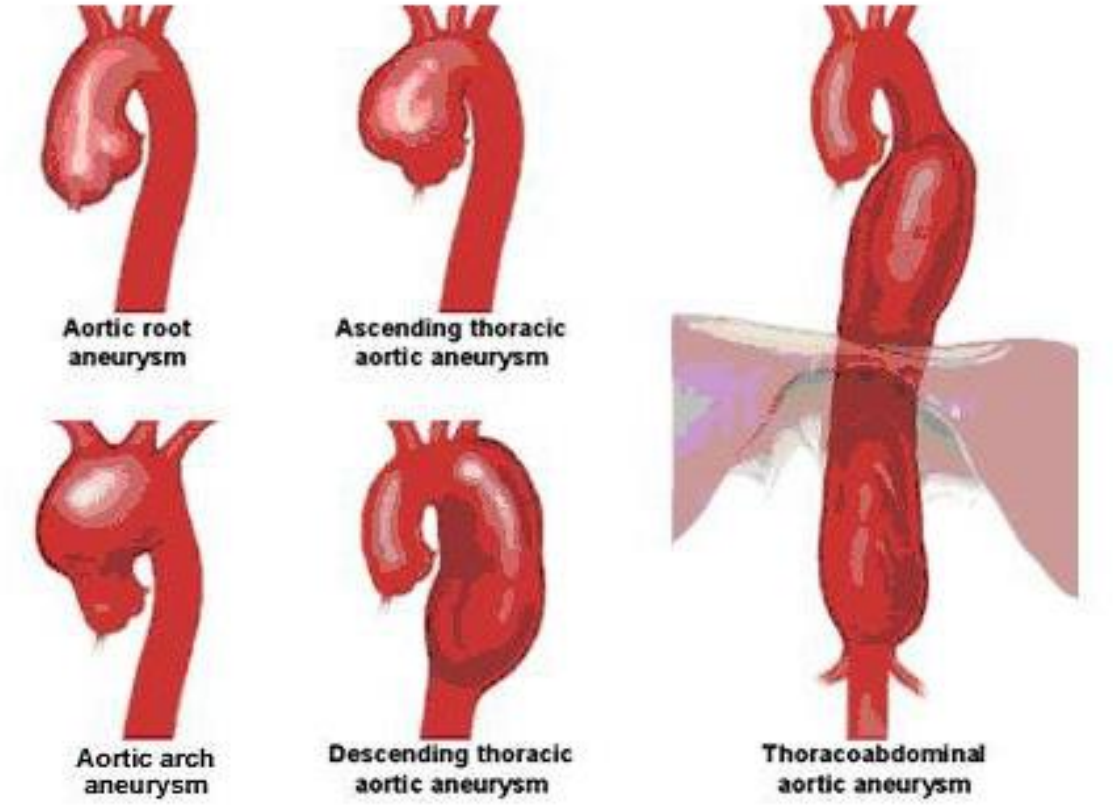
Sample echo

Great Vessels
Aorta

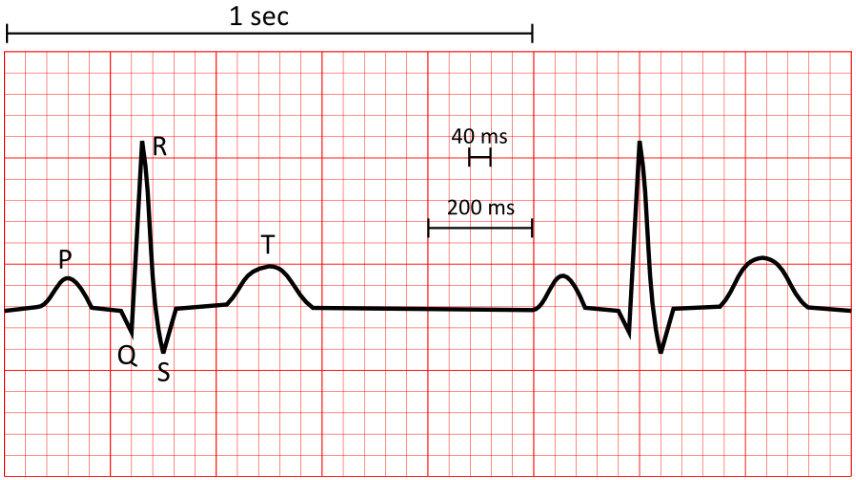
Sinus of Valsalva:	3.6	2.0-3.7 cm
Ao Asc:	2.9	2.1-3.4 cm

Great Vessels
No sinuses of Valsalva dilation measuring 3.56 cm and no ascending aorta dilation measuring 2.85 cm. The visualized portions of the pulmonary artery and branches are normal.

Some more aortic images….



What exactly is diastole…..?



www.nataliescasebook.com

- If the heart rate is 60, that is 60 beats(heart cycles) per minute.
- The actual pumping time (systole) is represented by the qrs complex, .10 sec.
- The remainder of the cardiac cycle is spent in diastole, .90 sec.
- In one minute, there is just 6 sec of actual pumping, with 54 sec of rest!

Phases of diastole….

- 1. Isovolumetric relaxation. Occurs just after systole where both the mitral and aortic valves are closed and the LV pressure has dropped
- 2. Early passive filling of the LV with the opening of the mitral valve
- 3. Late LV filling which occurs when the atria contract to squeeze remaining blood into the LV

- 9/10th of the time the heart is in a resting state. This state is also known as relaxation, repolarization or diastole.
- With advances in echo technology, diastole can be more accurately analyzed.
- The resting state of the heart is impacted by HTN, LVH and atherosclerosis.
- Aging has an impact on the relaxation of the muscle.
- Patterns of abnormal relaxation may be seen over age 60

Diastole Measured on Echo

- Mitral inflow…measure of Doppler flow at the tips of the mitral leaflets.
- Flow is represented as E and A waves. E = early filling and A = the late atrial contraction.
- Normal filling pattern occurs when most of the blood passively enters the LV due to the drop in pressure and then the atrial contraction contributes the remainder

Examples of some echo reports you may have seen...

Findings: The Left ventricle is normal in overall size and function, with an LVEF Of 55%. Wall thickness is mildly increased, consistent with mild concentric LVH There is grade 1 diastolic dysfunction.

Findings: The Left ventricle is normal size with mild increase in wall thickness. Mitral inflow reversal of E to A ratio, indicating grade I impaired relaxation.

Stage/Grade	Description	E/A diagram
Normal	Passive flow of blood in early filling of the LV (E)followed by late filling of the LV from the LA contraction(A)	Large E small A
Stage/Grade I impaired relaxation	Abnormal relaxation of the LV with forceful LA contraction during late filling to compensate	Small E large A, “E to A reversal”
Stage/Grade II (pseudo-normalization)	LA pressures continue to rise with both an increase in early and late filling	Increase in both E and A but ratio is normal
Stage/Grade III-IV Restrictive pattern	Markedly increased LA pressures and forceful early filling with minimal benefit from LA contraction in late filling	V. Large E wave and decreased A wave

Diastole measured on echo cont'd….

- Tissue Doppler Imaging (TDI)…. rather than measuring velocity of blood flow (as in the mitral inflow method), this measures the velocity of myocardial tissue motion using Doppler principles
- Other echo measurements include measuring pulmonary venous return as well as color flow mapping

More examples of Diastolic dysfunction on echo:

Summary: Analysis of mitral valve inflow, pulmonary vein Doppler and tissue Doppler signals suggest normal diastolic function.

Findings:
Left Atrium: The left atrial volume index is severely enlarged.
Left Ventricle: The left ventricle is normal in size, there is blunted systolic/diastolic Flow in the pulmonary vein indicating increased LA pressures. Ratios on TDI were elevated .
This along with the enlarged LA suggests significant diastolic dysfunction.

And why do we care about diastolic dysfunction….?

- DD can represent uncontrolled HTN or the effects of chronic HTN on the myocardium
- DD may be present with other conditions that cause LVH: Cardiomyopathy or valvular disease
- May be associated with chronic ischemia due to atherosclerosis or LVH
- May be associated with infiltrative diseases of the myocardium
- DD can lead to atrial enlargement which is then a risk for arrhythmia and stroke
- DD can be tricky to treat
- After a while, DD can become symptomatic and lead to systolic dysfunction

Couple new things on the horizon…..

3-D echo!....provides real time direct measurement without needing to do calculations as in the 2 d method. Improves accuracy and also give direct evaluation of the cardiac valves and congenital abnormalities.

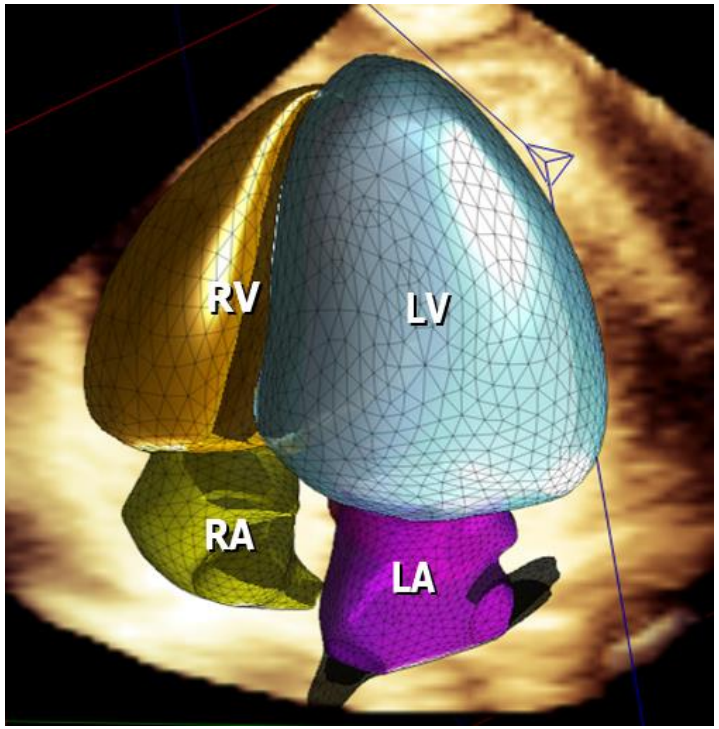


Image: UpToDate

New things, cont'd….

- Leadless pacemaker…

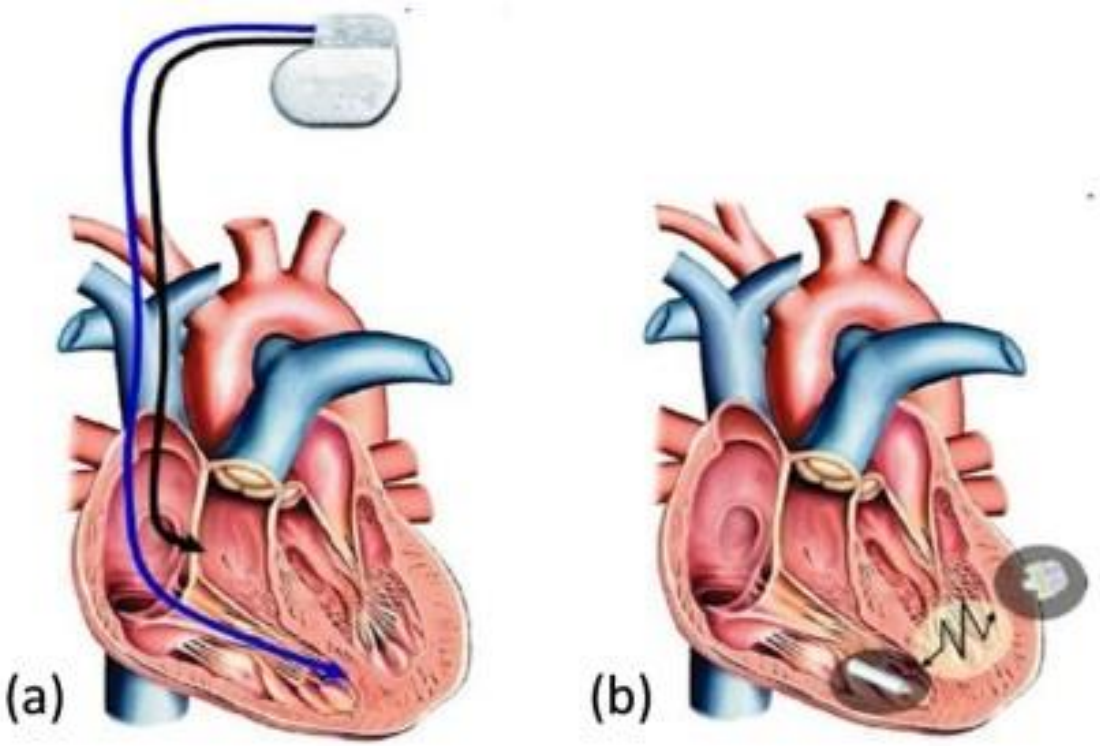


Image: www.embedded.com

THANK YOU!

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