

How to Examine the Cardiovascular System The Essentials 2013



Joel Niznick MD FRCPC

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To Become a Skilled Physician ◆ You Must Develop Physical Skills

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Specific Objectives


Specific Objective(s)

- A. 12077 - Describe a basic approach to the Physical examination of the Cardiovascular system including Inspection, palpation and auscultation.
- B. 12078 - Explain the basic heart sounds.
- C. 12079 - Describe how to perform a blood pressure.

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General Objectives:




- Demonstrate the basic use of the stethoscope.
- Approach to Vital Signs
 - Demonstrate how to properly measure the heart rate, and respiratory rate.
- Blood Pressure Measurement
 - Demonstrate how to take an office blood pressure as per the Canadian Hypertension Program (CHEP).
- Approach to CVS Exam
 - Explain a basic approach to the physical examination of Cardiovascular System including inspection, palpation and auscultation.
 - Demonstrate the normal location of the apical impulse.
 - Demonstrate manoeuvres to elicit the apical impulse and auscultation of the heart.

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How to Examine the Heart & Circulation




- For now we are just taking about the process and sequence of the exam
- Need to be able to recognize **normal** to diagnose **abnormal**
- Examine the heart & circulation from peripheral to central putting the pieces of the puzzle together as you go

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Examining the Heart and Circulation

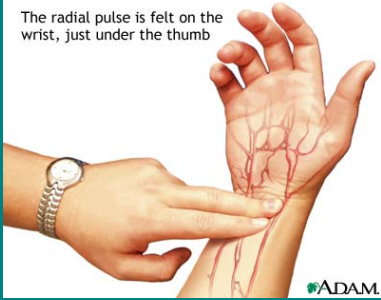


<ol style="list-style-type: none"> 1. Inspection <ul style="list-style-type: none"> – Form clinical impressions – Disease likelihood 2. Pulses <ul style="list-style-type: none"> – Rate and rhythm 3. BP 4. JVP <ul style="list-style-type: none"> – Height and waveform 5. Carotids <ul style="list-style-type: none"> – Palpate and auscultate 	<ol style="list-style-type: none"> 6. Palpation <ul style="list-style-type: none"> – Precordium and apex – Location, size, abnormal impulses 7. Auscultation <ul style="list-style-type: none"> – Precordium and apex 8. Peripheral pulses <ul style="list-style-type: none"> – Palpate and listen for bruits 9. Examine extremities <ul style="list-style-type: none"> – Arterial/venous insufficiency/trophic changes.....bridging the care gap
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Pulse



The radial pulse is felt on the wrist, just under the thumb



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Vital signs

- Heart Rate
- Count the pulse for 15 seconds - multiply X 4
- Count respiratory rate for 15 seconds X 4
- Patient should be unaware you are counting

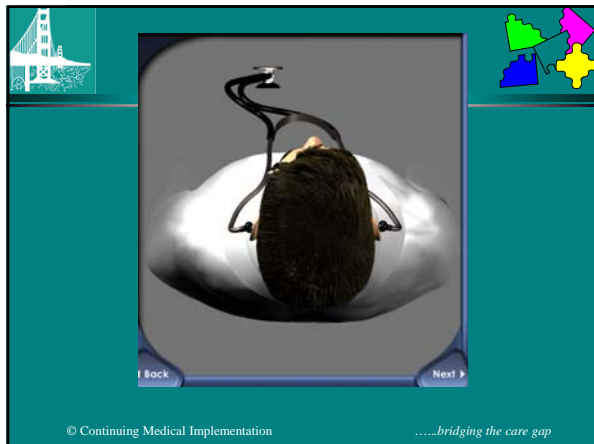



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Auscultation



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Establish the Stability of the Patient

<p><u>Acute Evaluation</u></p> <ul style="list-style-type: none"> • A - Airway – patent/obstructed • B - Breathing – rate/pattern • C - Circulation – HR/BP • D - Describe the patient 	<p><u>Elective Evaluation</u></p> <ul style="list-style-type: none"> • Comfortable/distressed • Dyspneic/fatigued • Pale/cyanosed • Diaphoretic • Dehydrated/volume depleted • Congested/edematous/volume overloaded
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Inspection

- Cyanosis
- Clubbing
- Xanthoma and xanthelasma
- Arcus senilis
- Stigmata of endocarditis
- Pectus excavatum/body habitus

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Cyanosis/Clubbing

Cyanosis




Clubbing



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Differential Diagnosis of Clubbing

- Cyanotic congenital heart disease
- Lung disease
 - Cystic fibrosis
 - Interstitial fibrosis
 - Malignancy
 - Sarcoidosis
 - Bronchiectasis
- Hyperthyroidism

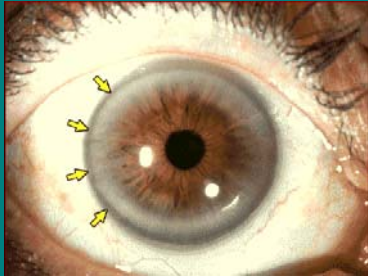


Clubbing of the fingers In a normal finger, the length of the proximal interphalangeal joint from point A to point B is about the same as the length of the distal interphalangeal joint from point C to D. In clubbing, the proximal interphalangeal joint is greater than the distance A-B. The other important change is the angle described by A-C-D. In the normal finger this is usually 90° degrees whereas in clubbing it is 180° degrees.
Reprinted from: Ophthalmology, 10th Edition, H. H. Kanski, Ed. Clinical profiles of diffuse interstitial pulmonary disease. Mosby, St. Louis, MO: Futary Publishing Company, Inc. 1990, pp. 90-91.

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Arcus senilis (juvenilis)

Arcus juvenilis. This ring is associated with premature atherosclerosis



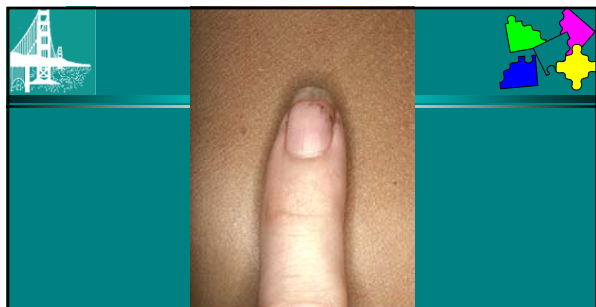
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Xanthelasma Yellow plaques are present bilaterally. With permission from Slomovits, TL (Ed), Basic and clinical science courses section, American Academy of Ophthalmology, San Francisco 1996.



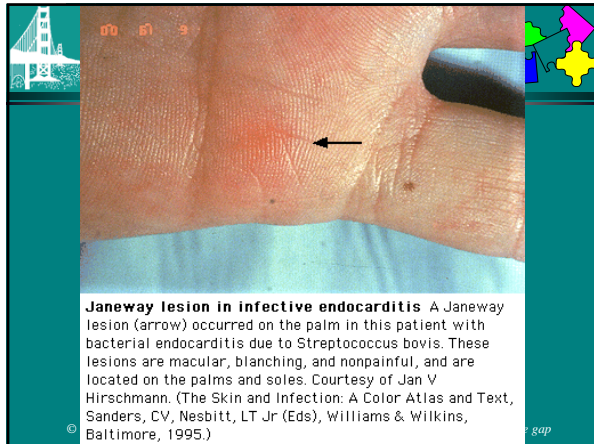
Subconjunctival petechiae in infective endocarditis Subconjunctival petechiae are prominent in this case of bacterial endocarditis caused by *Staphylococcus aureus*. Courtesy of Jan V Hirschmann. (The Skin and Infection: A Color Atlas and Text, Sanders, CV, Nesbitt, LT Jr (Eds), Williams & Wilkins, Baltimore, 1995.)



Splinter hemorrhages in infective endocarditis Splinter hemorrhages, linear reddish-brown lesions, are seen in the nail bed of this patient with bacterial endocarditis due to group D streptococcus. Courtesy of Gene Beyl (The Skin and Infection: A Color Atlas and Text, Sanders, CV, Nesbitt, LT Jr (Eds), Williams & Wilkins, Baltimore, 1995.)

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MARFAN Syndrome
<http://www.io.com/~cortese/marfan/>
 photographs used with permission

Body Habitus

- Tall/thin/long facies
- Long fingers
 - Thumb sign
 - Wrist sign
- Ligamentous laxity
- Scoliosis/kyphosis
- Pectus excavatum/carinatum
- Ectopia lentis
- Narrow long facies
- High arched palate

Pigmentation due to amiodarone



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Feel & Describe the Pulse

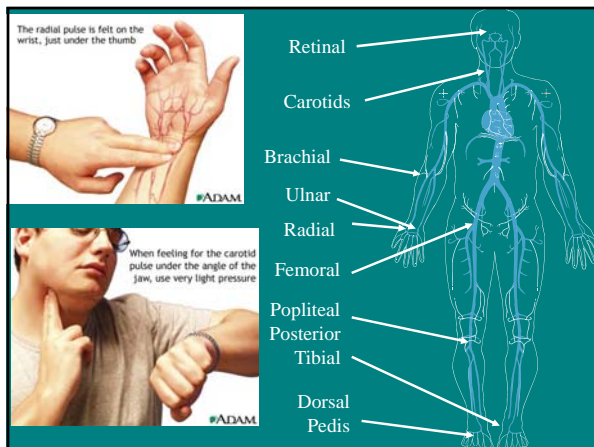
Rate

- Normal sinus 60-100 bpm
- Sinus bradycardia < 60 bpm
- Sinus tachycardia > 100 bpm

Regularity

- Sinus arrhythmia- varies with respiration
- Intermittent irregularity –ectopic beats
- Continuously irregular (irregularly irregular – atrial fibrillation)


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The radial pulse is felt on the wrist, just under the thumb.

When feeling for the carotid pulse under the angle of the jaw, use very light pressure.

Retinal
Carotids
Brachial
Ulnar
Radial
Femoral
Popliteal
Posterior Tibial
Dorsal
Pedis



Feel Pulse Volume & Contour




Palpate at large vessels:

- Forearm/Brachial/Carotid/Femoral


Describe:

- Volume: Normal/increased/decreased
- Slow rising +/- brachial-radial delay (aortic stenosis -AS)
- Collapsing or water hammer pulse - (aortic regurgitation - AR)
- Bifid (bisferiens -AS/AR or IHSS)
 - Pulsus paradoxus
 - Tamponade
 - COPD
 - Pulsus alternans
 - LV dysfunction

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Canadian Hypertension Education Program (CHEP)



RECOMMENDED BLOOD PRESSURE MEASUREMENT TECHNIQUE

1.

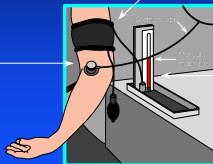
- The patient should be relaxed and the arm must be supported.
- Ensure no tight clothing constricts the arm.

2.

- The cuff must be level with heart
- If arm circumference exceeds 33 cm, a large cuff must be used.
- Place stethoscope diaphragm over brachial artery.

3.

- The column of mercury must be vertical.
- Inflate to occlude the pulse. Deflate at 2 to 3 mmHg. Measure systolic (first sound) and diastolic (disappearance) to nearest 2 mmHg.




<http://hypertension.ca/chep/recommendations-2009/>

Blood Pressure Assessment: Patient preparation and posture

Standardized technique:

Posture

The patient should be calmly seated for at least 5 minutes, with his or her back well supported and arm supported at the level of the heart. His or her feet should touch the floor and legs should not be crossed.



The patient should be instructed not to talk prior and during the procedure.

2006 Canadian Hypertension Education Program Recommendations 27

Blood Pressure Assessment: Patient position



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Blood Pressure Assessment: Patient preparation and posture

Standardized technique:

Patient

1. No caffeine in the preceding hour.
2. No smoking or nicotine in the preceding 15-30 minutes.
3. No use of substances containing adrenergic stimulants such as phenylephrine or pseudoephedrine (may be present in nasal decongestants or ophthalmic drops).
4. Bladder and bowel comfortable.
5. Quiet environment. Comfortable room temperature.
6. No tight clothing on arm or forearm.
7. No acute anxiety, stress or pain.
8. Patient should stay silent prior and during the procedure.



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Recommended Technique for Measuring Blood Pressure (cont.)

Select a
cuff with the
appropriate size



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Cuff size

Arm circumference (cm)	Size of Cuff (cm)
From 18 to 26	9 x 18 (child)
From 26 to 33	12 x 23 (standard adult model)
From 33 to 41	15 x 33 (large, obese)
More than 41	18 x 36 (extra large, obese)



Recommended Technique for Measuring Blood Pressure (cont.)

- Locate brachial and radial pulse
- Position cuff at the heart level
- Arm should be supported



Recommended Technique for Measuring Blood Pressure (cont.)

- To exclude possibility of auscultatory gap, increase cuff pressure rapidly to 20-30 mmHg above level of disappearance of radial pulse
- Place stethoscope over the brachial artery

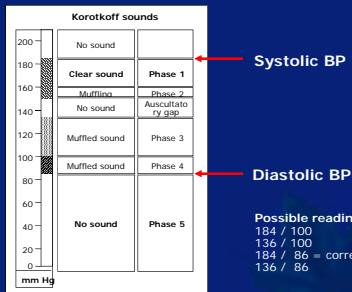


Recommended Technique for Measuring Blood Pressure (cont.)

- Drop pressure by 2 mmHg / sec
 - Appearance of sound (phase I Korotkoff) = systolic pressure
- Record measurement
- Drop pressure by 2 mmHg / beat
 - Disappearance of sound (phase V Korotkoff) = diastolic pressure
- Record measurement
- Take 2 blood pressure measurements, 1 minute apart



Recommended Technique for Measuring Blood Pressure (cont.)



Recommended Technique for Measuring Blood Pressure (cont.)

Record the blood pressure to the closest 2 mmHg on the manometer (avoid digit preference (0,5))

Record HR

Record the arm used

Record whether the patient was supine, sitting or standing.



Recommended Technique for Measuring Blood Pressure

Standardized technique:

- For initial readings, take the blood pressure in both arms and subsequently measure it in the arm with the highest reading.
- Thereafter, take two measurements on the side where BP is highest.



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Recommended Technique for Measuring Blood Pressure (cont.)

The seated blood pressure is used to determine and monitor treatment decisions.

The standing blood pressure is used to test for postural hypotension: elderly, diabetics, diuretics.

A fall in systolic BP > 10 mm Hg is significant



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BP Treatment Targets	Condition
160/100	Treatment threshold if no risk factors, TOD or CCD
< 140/90 Normal office BP	Treatment target for office BP measurement
< 135/85 Normal Home BP	Treatment target for for ABP or HBP measurement
< 130/80	Treatment target for for Type 2 diabetics or non-diabetic nephropathy or CAD (AHA)

Blood Pressure: Assessment Close Pop-Up Window

SECTION INSTRUCTIONS
 Click on the pump to begin the examination. By using the gauge, determine the blood pressure for this patient. Enter your answer in the text box to the bottom and hit the submit button to see if you are correct.
 (Each time the pump is clicked it brings up a new patient.)

What are the indications for checking the BP in both arms?

- The presence of both arms
 - R/O
 - Atherosclerotic obstruction
 - Scalenus anticus syndrome/cervical rib
 - Aortic coarctation above left subclavian
 - Anomalous origin right subclavian artery in aortic coarctation

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What are the indications for checking BP in the lower extremities?

- Hypertensive patient under 40 years of age.
- Elderly patient with suspected PVD

How do you do it?

- Thigh cuff-auscultate over popliteal artery
- Large arm cuff around calf (bladder posterior)
- palpate PT or DP

Which is normally higher- arm or leg BP?

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Ankle-Brachial Index

- Resting and post exercise SBP in ankle and arm.
 - Normal ABI > 1
 - ABI < 0.9 has 95% sensitivity for angiographic PVD
 - ABI 0.5- 0.84 correlates with claudication
 - ABI < 0.5 indicates advanced ischaemia

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Look at the Fundi




OSU Interactive Physical Exam Guide

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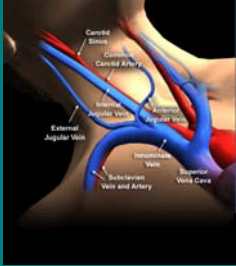
Look at the Fundi

- Disc
- Vessels
 - Hypertensive retinopathy
 - Diabetic retinopathy
- Hemorrhages
- Exudates



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Carotid Palpation

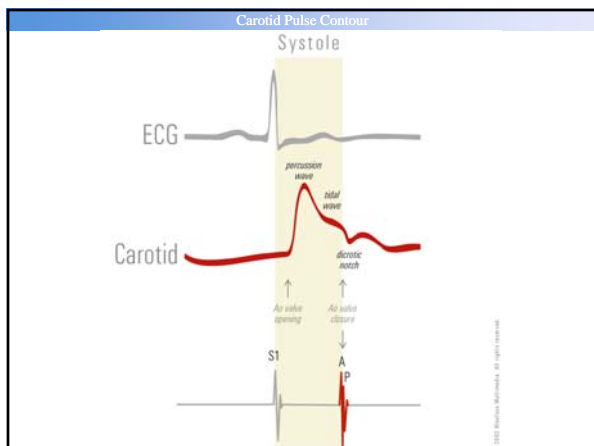



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Carotid Examination

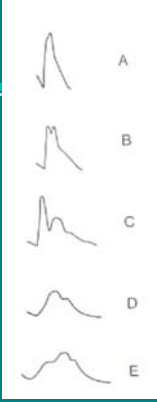
- Carotid upstroke
 - Brisk, normal or delayed
 - Volume: normal, increased or decreased
 - Anacrotic or Bisferiens
- Carotid auscultation
 - Bruit
 - Transmitted murmur
 - A² audible in neck? Presence excludes severe AS

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Carotid Pulse Contours

- A. Hyperkinetic
 - Aortic regurgitation
- B. Bifid
 - AS/AR
- C. Bifid typical of
 - IHSS
- D. Hypokinetic
 - LV dysfunction
- E. Parvus et Tardus
 - Aortic stenosis



<http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=cm&part=II.b.xml>

JVP Inspection

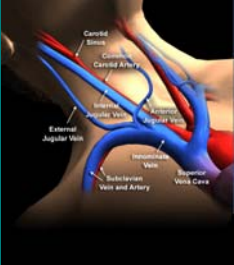


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Jugular Venous Pressure

To assess the volume status of the circulation

- Level
- Waveform
- Differentiate from carotid
 - Multiple wave forms
 - Compressible
 - Varies with inspiration and abdominal pressure



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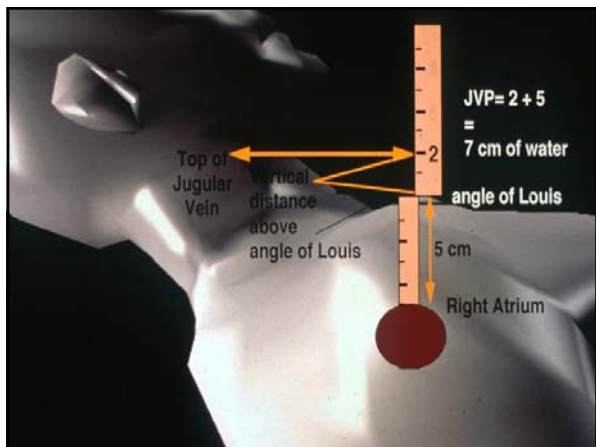
Jugular Venous Pressure



- Sternal angle is the reference point for JVP
- Level of sternal angle is about 5 cm above the level of mid right atrium IN ANY POSITION.
- JVP is measured in ANY position in which top of the column is seen easily.
- Usually JVP is less than 8 cm water
< 3 cm column above level of sternal angle.

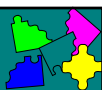
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Use the hand made ruler



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Normal JVP Waveform



- Consists of 3 positive waves
– a, c & v
- And 3 descents
– x, x'(x prime)
and y

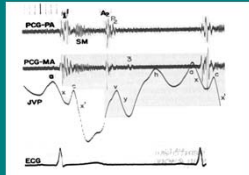


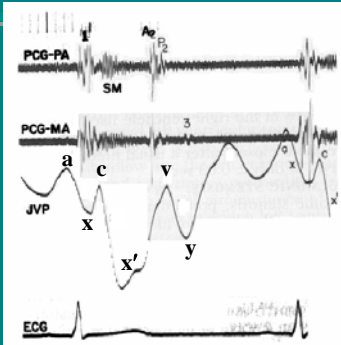
Figure 3-37. Normal jugular venous pulse (JVP) tracing in a young person with a functional systolic murmur (SM). The major features of the JVP are as follows: a wave, resulting from right atrial systole; c wave, atrial relaxation; v wave, tricuspid closure resulting from right ventricular contraction; x' descent, descent of the base plus continuing effect of atrial relaxation, associated with antegrade flow from the great veins; x wave, passive descent of descending aorta filling of the right ventricle following opening of the tricuspid valve; y wave, a stasis wave in the venous system, apparent only at slower heart rates.

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Normal JVP Waveform



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JVP Waveform Identification



- It's easier than it looks !!!
- Look for descents not waves
- Time deepest descent with systole
- **This is the x' (prime) descent !!!**
 - Occurs during systole due to RV contraction pulling down the TV valve ring “descent of the base”
 - A measure of RV contractility
 - If the dominant descent is systolic-this is the x' descent- and JVP waveform is normal

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Hepato-Jugular reflux and Kussmaul's sign



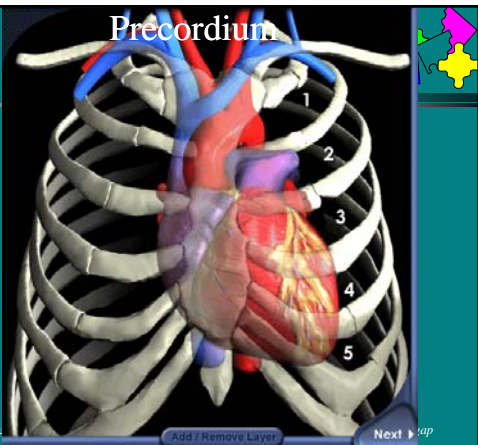
- Hepato-jugular reflux (various definitions)
 - sustained rise 1 cm for 30 sec.
 - ↑ venous tone & SVR
 - ↓ RV compliance
- Positive HJR correlates with LVEDP > 15
- JVP normally falls with inspiration
- Kussmaul's sign
 - inspiratory ↑ in JVP
 - constriction
 - rarely tamponade
 - RV infarction

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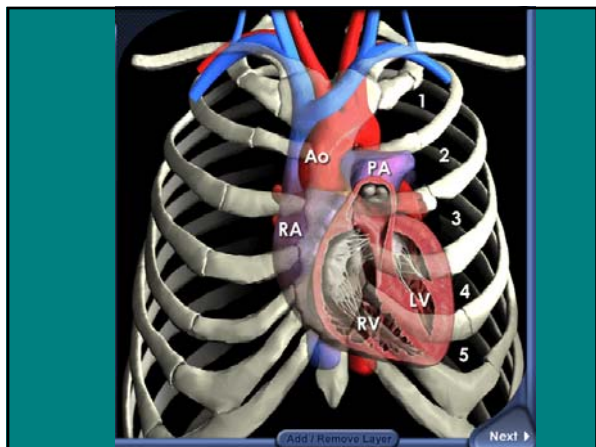
Precordium



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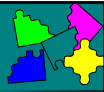


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Sequence of Precordial Palpation

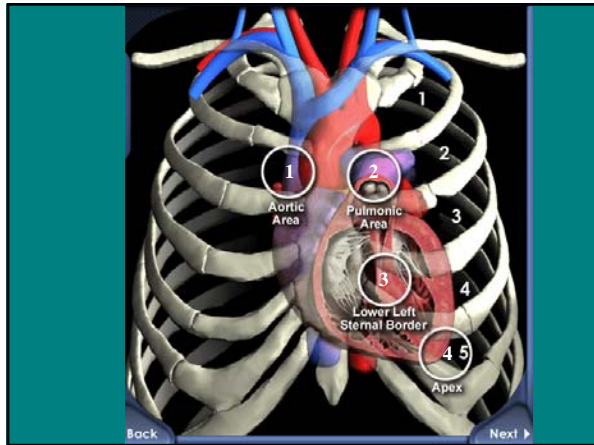


Sequence same as for Auscultation:

- Upper right sternal border - 2ICS (intercostal space)
- Upper left sternal border - 2ICS
- Parasternal (left sternal border 3rd - 5th ICS)
- Apex
- Apex left decubitus (patient rolled over halfway)
- Apex upright leaning forward

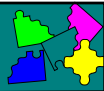
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Precordial Palpation



Parasternal:

- Lift: RV enlargement or severe MR
- Thrill: VSD, HOCM (IHSS)
- Palpable P2 (ULSB): pulmonary hypertension

Apex

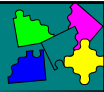
- Location
- Size

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Palpation - Apex



Apex:

- Palpable in 1 of 5 adults < age 40
- Best felt with fingertips or finger pads

Normal Location:

- No more than 10 cm from mid-sternal line in the supine position
- Left decubitus position not reliable for apical location

Normal Size:

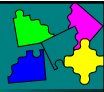
- No larger than 3 cm (about 2 finger breadths)

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Apex-Dynamic Qualities



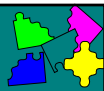
- LV impulse moves outward like a ping pong ball protruding between the ribs
- Apex moves outward for the first third of systole and falls away rapidly
- Lasts for no more than 2/3 of systole
- Sustained apex:
 - > 2/3 systole - hangs out to S2
 - correlates with LV pressure overload
 - AS, LVH or LV systolic dysfunction

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Apex-Dynamic Abnormalities



Hyperdynamic Apex:

- correlates with volume overload AR/MR

Palpable S4 (atrial kick) – stiff LV

- Loss of LV compliance
- LVH 2° Hypertension
- Aortic Stenosis
- Hypertrophic Cardiomyopathy


Palpable S1 (MS)

Palpable non-ejection click (MVP)

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Auscultation





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Auscultation

- Use the diaphragm for high pitched sounds and murmurs
 - Use firm pressure to bring out high pitched sounds and murmurs
- Use the bell for low pitched sounds and murmurs
 - Use light pressure to bring out low pitched sounds and murmurs
- If using tunable diaphragm
 - Firm pressure for high pitched sounds
 - Light pressure for low pitched sounds

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High- and Low-frequency Sounds Explained

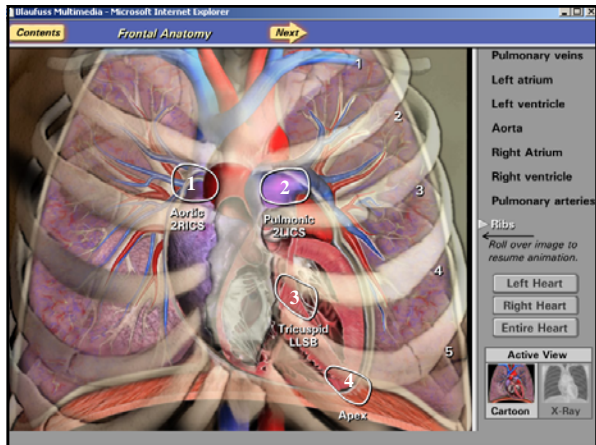
Dull, Low Frequency

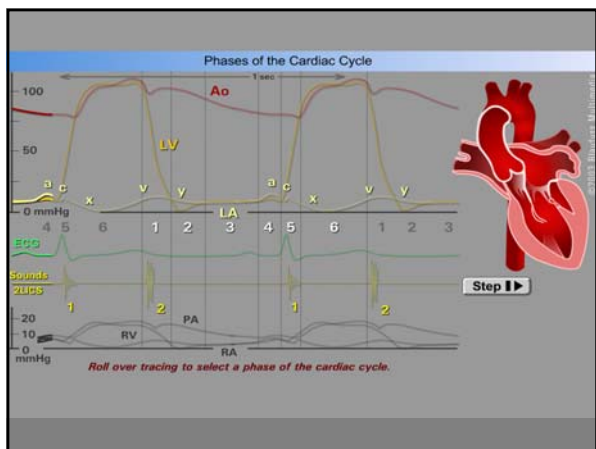
Sequence of Auscultation


- Upper right sternal border (URSB) with diaphragm
- Upper left sternal border (ULSB) with diaphragm
- Lower left sternal border (LLSB) with diaphragm
- Apex with diaphragm and then bell
- Apex - left lateral decubitus position with bell
- Lower left sternal border (LLSB)- sitting, leaning forward, held expiration with diaphragm

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
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Identify Heart Sounds




- S1 – closure of mitral valve
- S2 – closure of aortic (A2) and pulmonary valves (P2)
- S4 – pre-systolic sound
 - atrial contraction filling non-compliant ventricle
 - Low pitched, bell, apex
- S3 – early diastolic filling of volume overloaded ventricle
 - Low pitched, bell, apex



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Use your built in heart sound simulator




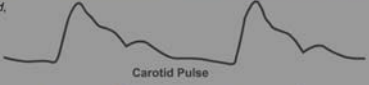
- Drum fingers on chest or table
- Auscultate with stethoscope
 - Ring finger S4
 - Middle finger S1
 - Index finger S2
 - Thumb finger S3


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Normal First and Second Heart Sounds

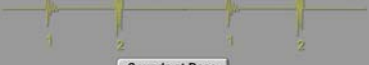
Note: sounds are slowed to half speed, (30 bpm) for this example.


Carotid Pulse



ECG

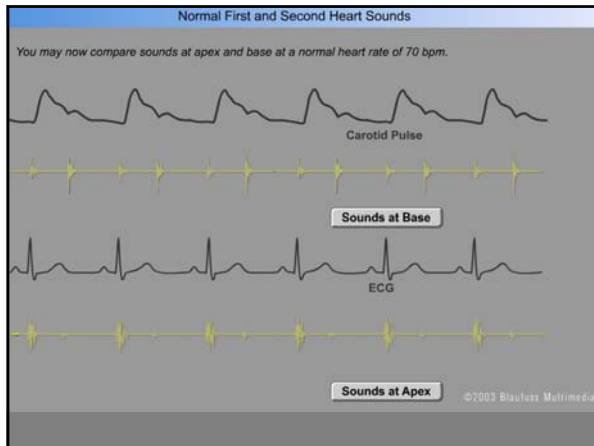


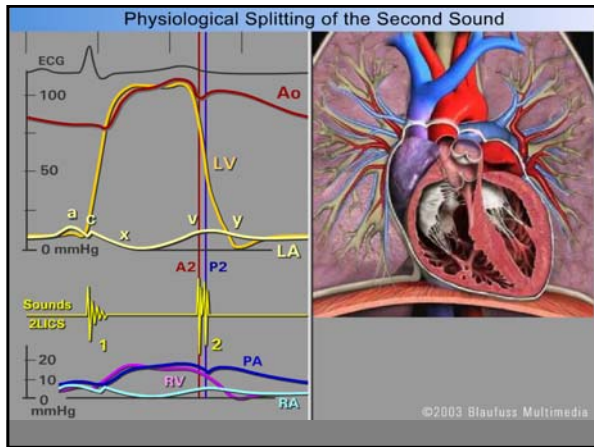
Sounds at Base

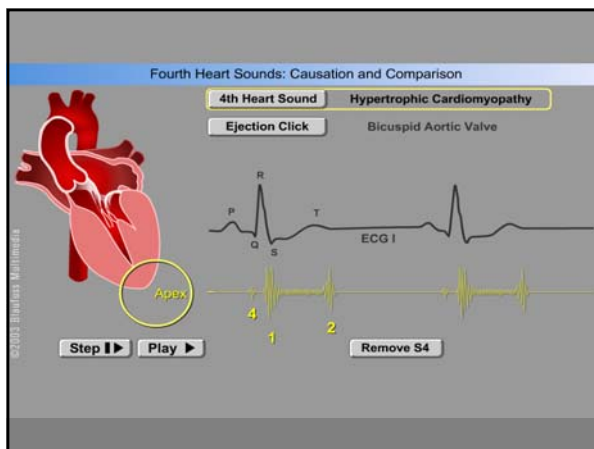


Sounds at Apex

© 2003 Blaufox Multimedia







Third Heart Sounds: Causation

© 2012 StatSoft Mathematics

Step ▶▶ Play ▶▶ Remove S3


Listen for Extra Sounds

- Systolic extra sounds**
 - Ejection click
 - Bicuspid aortic valve
 - Aortic root
 - Non Ejection click
 - Mitral valve prolapse
- Diastolic extra sounds**
 - Wide split S2
 - Pericardial knock
 - Opening snap of mitral stenosis


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Timing of Cardiac Sounds

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Listen for Murmurs




What is a murmur?

- A sound/vibration made by blood flowing through a normal valve or an abnormal valve.
- A sound made by blood flowing backwards through a leaking valve
- Murmurs may be functional or pathologic

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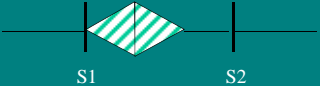


Functional Murmurs Common in Asymptomatic Adults



Characterized by


- Grade I – II @ LSB
- Systolic ejection pattern - no ↑ with Valsalva



S1 S2


- Normal precordium, apex, S1
- Normal intensity & splitting of second sound (S2)
- No other abnormal sounds or murmurs
- No evidence of LVH

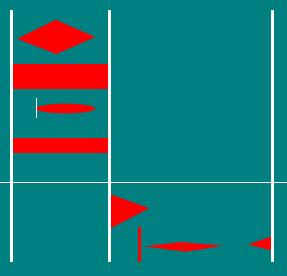
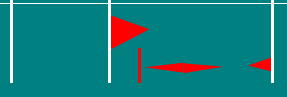
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Identify Murmurs and Timing


(Click over murmur icons to play)



<p><u>Systolic Murmurs</u></p> <ul style="list-style-type: none"> • Aortic stenosis • Mitral insufficiency • Mitral valve prolapse • Tricuspid insufficiency 	
<p><u>Diastolic Murmurs</u></p> <ul style="list-style-type: none"> • Aortic insufficiency • Mitral stenosis 	
	<p>S1 S2 S1</p> <p><small>© Continuing Medical Implementationbridging the care gap</small></p>




Assessing Murmur Intensity




Grading of Murmurs:

- Grade 1 - only a staff man can hear - faint
- Grade 2 - audible to a resident – need to focus to hear
- Grade 3 - audible to a medical student –easily heard
- Grade 4 - associated with a thrill or palpable heart sound
- Grade 5 - audible with the stethoscope partially off the chest
- Grade 6 - audible at the bed-side

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What are the types of murmurs?




<p>Systolic</p> <ul style="list-style-type: none"> • Ejection quality • Early, mid or late systolic • Pan-systolic e.g mitral or tricuspid regurgitation 	<p>Diastolic</p> <ul style="list-style-type: none"> • Early diastolic regurgitant quality e.g. aortic or pulmonary regurgitation • Diastolic rumble e.g. mitral stenosis +/- presystolic accentuation.
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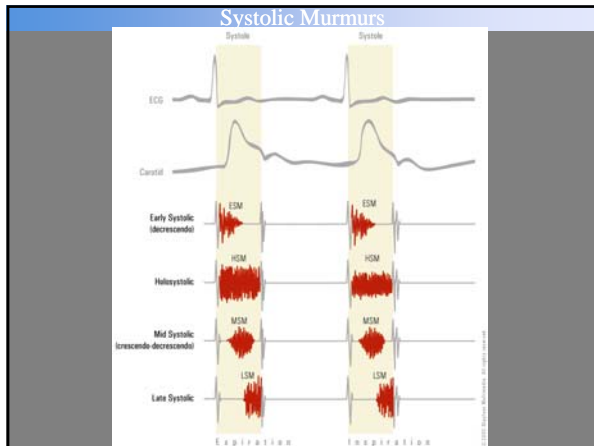


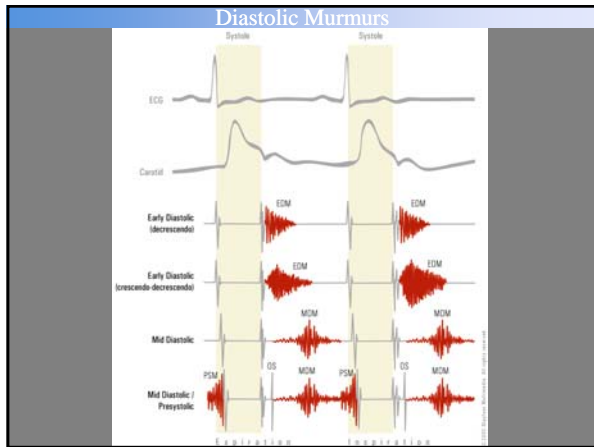
Characteristic of Pathologic Murmurs




- Diastolic murmur
- Loud murmur - grade 4 or above
- Regurgitant murmur
- Murmurs associated with a click
- Murmurs associated with other signs or symptoms e.g. cyanosis
- Abnormal 2nd heart sound – fixed split, paradoxical split or single


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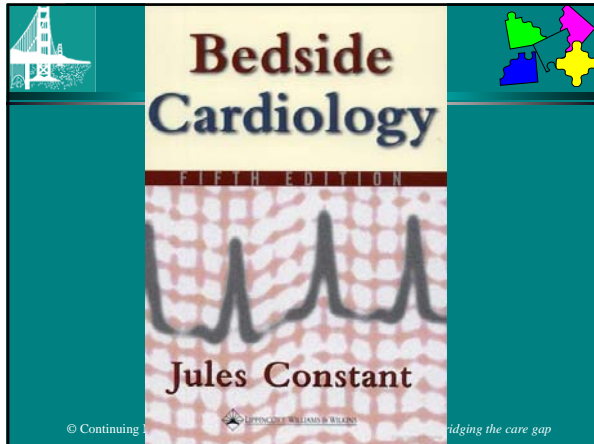


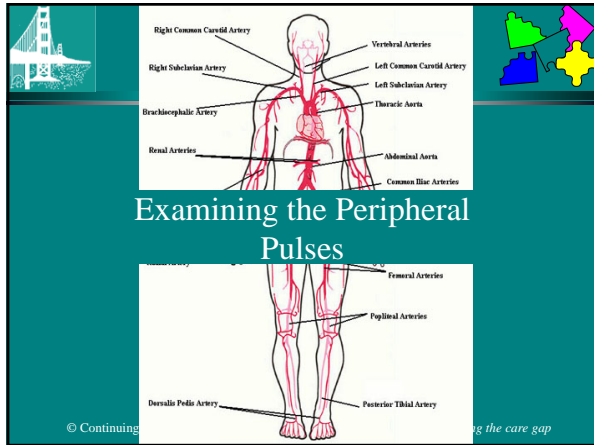
Examining the Heart and Circulation

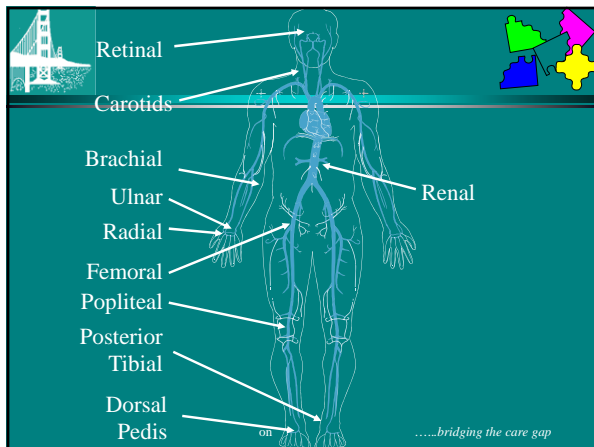



1. Inspection
2. Pulses
3. BP
4. JVP
5. Carotids
6. Palpation
7. Auscultation
8. Peripheral pulses
9. Examine extremities

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Examination of Pulses



- Grading:
 - Normal/Increased/Decreased/Absent
 - 2+/3+/1+/0
 - Allen's test
- Trophic changes/Ulceration
- Perfusion
 - Pallor on elevation
 - Rubor on dependency
 - Venous refill with dependency (should be less than 30 seconds)
- Bruits

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Trophic Changes



Shiny, hairless skin, dystrophic nail changes and dependent rubor associated with peripheral arterial occlusive disease of the patient's right foot



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Pallor on elevation





Medscape www.medscape.com

Rubor on dependency



Medscape www.medscape.com

Source: Wounds © 2003 Health Management Publications, Inc.

Digital Ischaemia Gangrene

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A Practical Guide to Clinical Medicine - UCSD

Acute Arterial Insufficiency:
Mottled Appearance of Skin

Chronic Arterial Insufficiency
with Ulcers

<http://medicine.ucsd.edu/clinicalmed/extremities.htm>

Measurement of the Ankle-Brachial Index (ABI)

Right ABI	Higher right-ankle pressure Higher arm pressure	Interpretation of ABI
Left ABI	Higher left-ankle pressure Higher arm pressure	

Right arm systolic pressure Left arm systolic pressure

Right ankle systolic pressure Left ankle systolic pressure

DP DP PT PT

Hiatt W. N Engl J Med 2001;344:1608-1621

THE NEW ENGLAND JOURNAL OF MEDICINE

Venous Abnormalities Varices

Before After

[Click To View More Examples](#)

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Spider Veins

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Venous Insufficiency

Healthy Venous Valves
Venous blood flows upward against gravity and any backflow is prevented by valves that shut against the flow.

Varicose Veins
The Valves become damaged and do not function properly. Backflow of blood is not prevented and "pooling" of blood stretches and balloons the vein walls.

Direction of blood flow
Superficial Skin Vein
Muscle
Thromboses in deep vein
Swelling and inflammation before discharge

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Stasis Dermatitis/Ulceration



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Edema



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Cellulitis vs DVT

Cellulitis



Right Deep Venous Thrombosis



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