Physical Exam Of The Cardio-Vascular System

James G. Laws D.O. MACOI
An Important Part Of The Physical Exam Of The Cardio-Vascular System That Is Commonly Overlooked Is?

| 20% | 1. Palpation Of The PMI Which Can Bring Out Findings Causing You To Suspect Mitral Stenosis. |
| 20% | 2. Auscultation Of Left Sternal Border Which Can Help In The Diagnosis Of Tricuspid Regurgitation. |
| 20% | 3. Auscultation Of The Neck Which Can Suggest Either Aortic Stenosis Or Carotid Stenosis. |
| 20% | 5. Checking For The Hepato-jugular Reflux Which Can Bring Out Signs Of Mitral Regurgitation. |
Always Begin Exam On Right Side Of The Patient

This Allows You To Reach Across The Patient To The PMI

This Allows The Stethoscope Tubing To Be Straight And Does Not Loop Down Making Contact With Patient Or Bed Covering

Remember The Shorter The Tubing The Less Distance The Sound Has To Travel

Always Expose The Chest For The Best Results

Best Exam Done With The Patient At 40-60 Degree Head Up Position

40° to 60°
Always Begin Exam With Palpation Then Go To Auscultation

First Check The PMI

Second Palpate Both The Carotids And The Femorals

Third Palpate The Aorta

Fourth Compare Both Radials
Apex Beat = PMI

Note How Close Carotids Are to Both The Skin of Neck And The Aorta
Note Relationship Between Nipple Line And PMI
GUESS WHERE You Should Place Your Hand To Begin Palpation Of The Chest?

If The LV Is Enlarged What Happens To The PMI???

Duhhh

CORRECT !!!!

Down And To The Left
Guess What This Will Do To The PMI

And If The Heart Is Also Dilated It Will Be Moved Down As Well

You Guessed Right If You Said It Moved It To The LEFT
Where Will The PMI Be On A Patient With This Thick Dilated Heart!!!

Yep
Down And To The Left
Why Does This Happen???

The LV Will Now Have To Pump 8 liters/Min.

How Does The LV Respond To This Volume Overload

The LV Will Dilate And Again A Large Heart

The LV Will Pump The Normal Cardiac Output Plus The Leak

Once Again A Volume Overload

What Will Happen To The PMI

Same Thing Can Happen To Ao. Valve

Once Again A Volume Overload

The LV Will Pump The Normal Cardiac Output Plus The Leak

Why Does This Happen???
Normal Size LV BP120/80

LV With A Pressure Overload Such As HBP Or AS 210/?

A Vol. Over Load LV AI Or MR
Severe Pulmonic Stenosis

Note The Marked Thickening Of Right Ventricular Myocardium

What Will This Do To The PMI?

Correct !!!! If You Said It Will Move MEDIALLY
And RV Enlargement Is Up And Medial Near The Sternum

Acute MI Would Be In Normal Position. (Not Enough Time For Change To Take Place)

Sooooo LV Enlargement Is Down And Left
Bounding Pulse
Waterhammer Pulse
Wide Pulse Pressure
Corrigan’s Pulse

Caused By The Large Volume Of Blood Being Ejected Through The AV i.e. The Normal Forward Flow Plus The Regurgitant Volume

Palpation Of Carotid Pulse Is Often Overlooked During Physical Exam

Aortic Stenosis Slow Upstroke
Prolonged Pulse

Normal
Eliciting The Hepatojugular Reflux
(A Sign Of Right Heart Failure Usually Following Left Heart Failure)

Patient Must Be Relaxed
Breathing Normally

Trunk Elevated 30 Degrees

Firm Sustained Pressure On Abdomen While Observing Jugular Pulse

If Face Turns Red
Patient Is Holding Their Breath Or Doing A Valsalva
Either Of Which Results In Error

This Causes Venous Pressure To Rise And Gives A False Positive

With Right Heart Failure Or Constrictive Pericarditis The Jugular Pulse Level Rises
Start Your Exam From The Patient’s Right So Your Stethoscope Tubing Will Be In A Straight Line To The Area You Are Listening To i.e. Less Noise Banging On The Patient And Less Resistance To Air Flow.

Use Reverse Z To Auscultate All Valve Areas.

Right Aortic Left Pulmonic Tricuspid Neath The Sternum The Mitral Gets The Apex Beat

Here’s How I Was Taught Auscultation When I Was A Student

After Palpation Comes Auscultation

Auscultation Of The Neck In My Experience Is Commonly Overlooked.
Must Re-Emphasize Relationship Between Carotids and Aorta

Left Carotid Arises Directly From The Aorta

Right Carotid Arises From The Brachio-Cephalic Trunk

QUESTION? Which Carotid Might Transmit An Aortic Murmur The LOUDEST?

Duhhhhhh
Carotid Bruits Are High Pitched And I Feel Best Heard With The Diaphragm

One Of The Most Commonly Missed Parts Of The Physical Exam Is Auscultation Of The Neck

But As Long As You Auscultate The Carotids I Don’t Care What Side Of The Stethoscope You Use

Note They Have Auscultated From Base To Angle Of Jaw Or Vice Versa

Carotid Bruits Are

So This One Part Of The Physical Exam Allows Evaluation Both For AS And Carotid Stenosis
With this anatomy in mind, why is it logical to listen to the areas just described?
Tricuspid Valve Just Beneath Xiphoid

Mitral Valve Very Posterior Heard By Using The LV As A Megaphone
Remember the aorta and the pulmonary artery cross each other.

Right 2nd Intercostal Space Equals Aortic Listening Post

Left 2nd Intercostal Space Equals Pulmonic Listening Post

AI Heard Along Left Sternal Border

Remember the aorta and the pulmonary artery cross each other.
Most Common Differentiation Between Murmurs Physicians Will Need To Make Is Between AS And MR

Commonly These Patients Will Have PVC’s And These Can Be Used To Differentiate Between These Two Murmurs
PULSUS ALTERNANS
(A Sign Of Heart Failure)

When Taking B.P.
Lower the cuff pressure to the level where Korotkoff sounds first heard.
Less forceful alternate beat does not pass this systolic pressure.

Take pulse at wrist.
HR will be half that detected by auscultation of heart.

Very common in cath lab to have high low alternation of LV systolic pressure in a heart failure case.
You can take advantage of this in an office setting.
How To Auscultate For Gallop Sounds

Raising the legs will increase return to heart and can bring out both gallops or murmurs.

You do need to listen to the heart, however.

You can also exercise the patient by having them hop up and on one leg or do sit ups.
Aortic Insufficiency Is Difficult To Hear

Best Heard With Patient Sitting Up
Leaning Forward
In Full Exhalation
All This Brings Heart Closer To Chest Wall
Use The Diaphragm In The 3rd Or 4th Left Intercostal Space
Another Position That Brings Heart Closer To Chest Wall
Also Have Patient Exhale Then Examine During Exhalation

Remember
For AI Listen In 3rd Or 4th Intercostal Space Just Left Of Sternum Use The Diaphragm
The Murmur Of Mitral Stenosis Is Also Very Difficult To Hear

Listen For This Murmur With The Bell

Have Patient In Left Lateral Decubitus Position. Place Yourself On Their Right Side As Shown

Start Auscultation Halfway Between The PMI And The Xiphoid Process

Exercise Such As Sit-ups In Bed Can Bring Out This Murmur
Thickness of Septum Is Fixed

Outflow Tract Obstruction

IHSS Or Obstructive Cardiomyopathy

Note The Obstruction Is Much Worse

During Valsalva The LV Gets Smaller i.e. Less Volume

Soooo What Happens To The Murmur During Valsalva?
A Very Soft Systolic Murmur Could Be Heard At 4LSB

No Pressure Gradient

Aortic Pressure

LV Pressure
Aortic Pressure
LV Pressure
Gradient During Valsalva
Sooooo What Would Have Happened To The Loudness Of The Murmur???
Same Patient
Pressures Measured During Valsalva
Aortic Pressure
LV Pressure
Gradient During Valsalva
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An Important Part Of The Physical Exam Of The Cardiovascular System That Is Commonly Overlooked Is?

- Palpation Of The PMI Which Can Bring Out Findings Causing You To Suspect Mitral Stenosis.
- Auscultation Of Left Sternal Border Which Can Help In The Diagnosis Of Tricuspid Regurgitation.
- Auscultation Of The Neck Which Can Suggest Either Aortic Stenosis Or Carotid Stenosis.
- Comparison Of Both Radial Pulses Which Can Suggest Ascending Aortic Aneurysm.
- Checking For The Hepato-jugular Reflux Which Can Bring Out Signs Of Mitral Regurgitation.
The End

Any Questions?
Post PVC Beat Greater Contractility Causes Increased Gradient

Valsalva Results In Smaller LV Cavity But Septal Thickness Remains The Same Therefore More Obstructive And Murmur Increases
Important Bedside Tool To Differentiate AORTIC STENOSIS From MITRAL REGURGITATION
AMYL NITRITE

DIMinishes murmurs of:

MITRAL REGURGITATION
VENTRICULAR SEPTAL DEFECT
PATENT DUCTUS ARTERIOSUS
TETRALOGY (RIGHT SHUNT)
AORTIC REGURGITATION

INCREASES murmurs of:

TRICUSPID REGURGITATION
PULMONIC STENOSIS
AORTIC STENOSIS
SUBAORTIC STENOSIS
MITRAL STENOSIS
VENTRICULAR RESPONSES TO LOAD

A. VOLUME LOAD

B. PRESSURE LOAD

RIGHT VENTRICLE

R.V. L.V.

R.V. L.V.

LEFT VENTRICLE

R.V. L.V.

R.V. L.V.
Remember !!!
Aortic Insufficiency Causes
Bounding Carotids And Wide Pulse Pressure

One Of The Most Frequently Overlooked Portions Of The Physical Exam Of The HEART Is Palpation And Auscultation Of The Carotids.
SUSTAINED HANDGRIP

- Cardiac Output
- Heart Rate
- Arterial Pressure
- Systemic Resistance
- LV Filling Pressure
SUSTAINED HANDGRIP

MITRAL REGURGITATION

MITRAL STENOSIS

AORTIC REGURGITATION

VENTRICULAR SEPTAL DEFECT

INCREASES MURMURS OF
Remember Larger The LV Less Obstructive The Septum Smaller The LV More Obstructive
Had Holter While Driving A Motorcycle Down A Ohio Highway At Over 100 Miles Per Hour Showed Him To Be Going In And Out Of VT

Note Thickening And Redundantancy Of The Mitral Valve Including Leaflets Cordae And Papillary Muscle
Increased Blood Volume Causes The Mitral Leaflets And Cordal Structures To Reach The Point Where They Suddenly Stop Later In Systole Therefore The Mid Systolic Click Occurs Later During Systole

Decreased Blood Volume Allows The Mitral Valve Apparatus To Reach The Point Where It Suddenly Stops At An Earlier Time During Systole Therefore The Mid Systolic Click Occurs Earlier In Systole
Control
Click Is Mid Systolic

Standing Reduces Volume Return To Heart
Mitral Structures Reach Their End Sooner Click Earlier

Squat Increases Volume Return Mitral Structures Reach Their End Later Click Later
Hypokinetic Pulse (Small, Weak)

1. Related To Decreased Rate Of Rise Of L.V. Press.
2. Related To Decreased Stroke Volume Of L.V.
3. Related To Obstruction To Outflow Of L.V.
Acute MI Normal
No Time For Change
To Take Place

And
RV Enlargement
Is
Up And Medial
Near The
Sternum

Sooooo
LV Enlargement
Is
Down And Left

24-A
Commonest location of maximal impulse in
LVH, RVH and myocardial infarction (MI)
(after Eddleman & Harrison)
Hyperkinetic (Large, Strong; Waterhammer; Collapsing; Corrigan)

1. Related To Increased Rate Of L.V. Press. Development

2. Related To Large L.V. Stroke Volume With Decreased SVR

3. Pulse Press. May Be Increased (AI Or PDA) Or Normal (IHSS, MR)
Anacrotic Pulse ( Twice Beating Type)

1. Produced By An Anacrotic (Upslope) Shoulder Or Halt On Ascending Limb Of Arterial Pulse

2. Only Rarely Appreciated On Physical Exam When Present
   Best Felt In Carotid

3. Very Frequently Recorded Especially In Aortic Stenosis
Pulsus Parvus et Tardus

1. Pulse With Slow Rate Of Press. Increase

2. A Small Pulse Pressure

3. A Late Systolic Peak

4. A Slow Collapse

5. Frequently Associated With AS (Discrete Obstruction To L.V.)
DIFFERENTIATION OF MURMURS

1. RESPIRATORY VARIATION
2. VALSALVA MANEUVER
3. POST PREMATURE BEAT
4. POSTURAL CHANGES
5. PHARMACOLOGIC AGENTS
6. SUSTAINED HANDGRIP
Physical Exam Of The Heart
And
Special Maneuvers

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Bisferiens Pulse

1. Twice Beating Pulse Produced By Two Palpable Pulse Waves In Systole

2. Two Waves That Are Exaggerations Of Waves That Can Be Recorded

3. These Two Waves Are Referred To As Percussion Wave And Tidal Wave

Best Felt In Carotid
Dicrotic Pulse

1. A Type Of Twice Beating Pulse Or Double Pulse

2. Combination Of Systolic Pulse Wave Followed By A Palpable Dicrotic Wave

3. This Is Distinct From Two Systolic Peaks i.e. Bisferiends Pulse

4. Classically Found In Sever Cardiac Failure, Hypovolemic Shock, or Cardiac Tamponade
DECISIONS FOLLOWING INTERPRETATION OF MURMURS

1. ENDOCARDITIS ANTIBIOTIC PROPHYLAXIS
2. RHEUMATIC FEVER ANTIBIOTIC PROPHYLAXIS
3. RESTRICTION OF ACTIVITY
4. NEED FOR FURTHER CARDIAC EVALUATION
DIFFERENTIATION OF MURMURS

1. RESPIRATORY VARIATION
2. VALSALVA MANEUVER
3. POST PREMATURE BEAT
4. POSTURAL CHANGES
5. PHARMACOLOGIC AGENTS
6. SUSTAINED HANDGRIIP
This Will Bring Heart Closer To Wall
Increased Intrathoracic Pressure Decreases Return Of Blood To Heart

But!!!!
Decreased Blood In LV Causes Thick Septum To Be More Obstructive

Less Blood In LV Decreases Murmurs Of MR And AS
Pulsus Paradoxus

1. Abnormal Exaggeration Of Normal Decrease Of Systolic BP During Inspiration

2. Frequently Associated With Abnormal Decrease In Filling Of L.V. During Inspiration

3. Causes Include Compression Of Myocardium (Pericardial Tamponade) Or Decrease Lung Compliance
Bigeminal Pulse (Bigeminy)

1. Regular Coupling Of Two Beats With Interval Between Pair Greater Than Interval Between Coupled Beats

2. Second Beat Usually A Premature Beat

3. Other Mechanisms Occur i.e. 3:2 Wenckebach And Non Conducted Premature Atrial Beat
# Dynamics of LV Outflow Tract in IHSS

<table>
<thead>
<tr>
<th>Contractility</th>
<th>LV Systolic Volume</th>
<th>Outflow Distending Pressure</th>
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<tbody>
<tr>
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<td><strong>Valsalva Maneuver</strong></td>
<td><strong>Amyl Nitrite</strong></td>
</tr>
<tr>
<td>- Post PVC</td>
<td>- Sitting, Standing</td>
<td>- Nitroglycerin</td>
</tr>
<tr>
<td>- Exercise</td>
<td>- Amyl Nitrite</td>
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<td>- Bradycardia</td>
<td>- Sitting, Standing</td>
<td>- Nitroglycerin</td>
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<td>- Propranolol</td>
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<td>- Exercise</td>
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<td>- Sitting, Standing</td>
<td>- Nitroglycerin</td>
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<tr>
<td>- Phenylephrine</td>
<td>- Amyl Nitrite</td>
<td>- Isoproterenol</td>
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<tr>
<td>- Squatting</td>
<td>- Exercise</td>
<td>- Isoproterenol</td>
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<td>- Head Down Tilt</td>
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A few sit-ups performed by the patient prior to assuming this position may strikingly accentuate the murmur. (For this maneuver the patient is instructed to elevate her chest from the bed by supporting her weight on her left elbow.)
First: Check PMI

Second: Palpate Both Carotid and Femoral Pulses

Third: Auscultate Both The Carotid And Femoral Areas

Compare Both Radial Pulses
You do need to have your stethoscope on the patient's chest however.

Gallop sounds may be accentuated by elevating both extended legs of the patient to an angle of 40° to 60°. (The patient should keep his legs relaxed during this maneuver.)

Exercise is useful in accentuating most faint murmurs. Ten to 20 sit-ups in bed are usually sufficient, but ambulatory patients can hop in place for 20 to 30 seconds to achieve a greater cardiac output increase.
Always Begin Exam On Right Side Of The Patient

Remember The Shorter The Tubing Of The Stethoscope The Less Distance The Sound Waves Have To Travel

This Allows Stethoscope Tubing To Be Straight And Does Not Make Contact With Patient Or Bedding

The patient should be recumbent, the thorax elevated from 40 to 60 degrees, and the head comfortably supported on a pillow so the neck can be completely relaxed. Always perform the examination from the patient’s right side. The room should be quiet.
AORTIC DIASTOLIC MURMURS ARE BEST HEARD WITH THE PATIENT SITTING UP, LEANING FORWARD, BREATH HELD IN FULL EXPIRATION, AND THE STETHOSCOPE DIAPHRAGM PLACED JUST BELOW THE PULMONIC AREA.

Patients In Bed can roll onto Abdomen And Prop Up On Elbows Place Stethoscope Under Them Against Their Chest 4LSB

Employ maneuvers at patient’s bedside which improve the examiner’s ability to hear and to identify certain murmurs.
PULSUS ALTERNANS IS A SIGN OF EARLY CONGESTIVE FAILURE

Note:
Very Common In Cath Lab To Have Alternating High Low Systolic BP Of LV Pressure Curve In Patients With Heart Failure
Thickness Of Septum Is Fixed

Therefore When LV IS Smaller Then Relative Obstruction Is Greater
ELICITING THE HEPATOJUGULAR REFLUX

- The patient must be relaxed and breathing normally
- The trunk is elevated 30° from the horizontal
- Firm, sustained pressure is exerted on the abdomen while the jugular veins are observed
- In right heart failure or constrictive pericarditis, an ascending level of distention or pulsation occurs with this maneuver

ERROR: If the patient holds his breath and strains (Valsalva maneuver), jugular venous pressure will rise and give a false positive test.

Figure 2

If Face Turns Red
Probably Holding Breath
Increased Return To Right Heart Prolongs RV Systole Delaying Closure Of Pulmonic Valve

Increased Capacitance Of Pulmonary Vasculature Causes Slower Rate Of Flow Into The Pulmonary Artery System Also Delaying Closure Of Pulmonic Valve
Redundant Tissue Of Mitral Valve Apparatus Leads To Prolapse
**Murmur**

**MITRAL REGURGITATION**

Murmur Unchanged

**AORTIC STENOSIS**

Murmur Increased In The Post PVC Beat
<table>
<thead>
<tr>
<th>Name</th>
<th>Derivation</th>
<th>Meaning</th>
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<tr>
<td>Anacrotic</td>
<td>Ana: up (Greek)</td>
<td>(1) A small slow-rising pulse with a notch on the ascending limb</td>
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<td>Krotos: beat (Greek)</td>
<td>(2) Twice beating on the upstroke</td>
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<tr>
<td>Dicrotic</td>
<td>Di: twice (Greek)</td>
<td>One in which the dicrotic wave is exaggerated</td>
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<td></td>
<td>Krotos: beat (Greek)</td>
<td></td>
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<tr>
<td>Bisferiens</td>
<td>Bis: two (Latin)</td>
<td>A pulse with two palpable peaks</td>
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<tr>
<td></td>
<td>Feriere: to beat (Latin)</td>
<td></td>
</tr>
<tr>
<td>Waterhammer</td>
<td></td>
<td>The shock wave produced in a pipe when movement of fluid is suddenly stopped</td>
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Anacrotic: Displaying Anacrotism - Anacrotic Limb = The Up-Stroke Of The Pressure Pulse. Anacrotism = An Irregularity Of The Ascending Curve Of The Pressure Pulse
“In December I Laid A common Field Gate On The Ground, On Which A White Mare Was Cast On Her Side, And In That Position Bound fast To The Gate. Then Laying Bare The Left Carotid Artery, I Fixed To It Towards The Heart The Brass Pipe And To That The Wind Pipe Of A Goose; To The Other End Of Which A Glass Tube Was Fixed Which Was Twelve Feet Nine Inches Long. The Blood Rose In The Tube In The same manner As In The Case Of The Two Former Horses, Till It Reached To Nine Feet Six Inches Height”

Experiment III
From “STATICAL ESSAYS” 1733
By The Rev. Stephen Hales