Heart Sounds and Murmurs

Wendy L. Wright, MS, RN, ARNP, FNP, FAANP
Family Nurse Practitioner
Owner – Wright & Associates Family Healthcare
Partner – Partners in Healthcare Education

Objectives

Upon completion of this lecture, the participant will be able to:

- Describe the various systolic and diastolic heart murmurs
- Discuss signs and symptoms of individuals with the various heart murmurs
- Identify various murmurs based upon their presentation and sounds

Valves

- Valves
  - Tricuspid - between right atrium and right ventricle
  - Mitral - between left atrium and left ventricle
  - Aortic - between left ventricle and aorta
  - Pulmonic - between right ventricle and pulmonary artery
Anatomy and Physiology

Sequence of Valve Closure

1. Systole: Period of ventricular contraction
   - During systole, the pressure in right and left ventricles increases
   - This causes the blood to be ejected from the ventricles into the pulmonary artery and the aorta
   - The aortic and pulmonic valves are open to allow emptying and the mitral and tricuspid valves are closed to prevent regurgitation of blood during the contraction

2. Diastole: Period of ventricular relaxation
   - During diastole, the pressure in right and left ventricles decreases
   - This allows the chambers of the heart to fill
   - The aortic and pulmonic valves are closed to prevent blood from escaping and the mitral and tricuspid valves are open to allow filling

Cardiac Physical Examination

Auscultation

Locations

- Auscultate in 5 locations with the bell and the diaphragm
- Aortic - 2nd ics, right sternal border
Cardiac Physical Examination

- **Pulmonic** - 2nd ics, left sternal border
- **Erb’s point** - 4th ics, left sternal border
- **Tricuspid** - 5th ics, left sternal border
- **Mitral** - 5th ics, left midclavicular line

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Cardiac Physical Examination

- **Heart Sounds**
  - **S1**: Mitral and Tricuspid closure
    - Abnormally loud: Mitral stenosis

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Cardiac Physical Examination

- **S2**: Aortic and Pulmonic closure
  - Physiologic split: common, widens with inspiration
  - Fixed split: ASD, pulmonary stenosis
- **S3**: Early diastole
  - 2 types: Physiologic and Pathologic
S3 Heart Sound

- Physiologic
  - Heard in about 1/3 of children under 16
  - Rarely in adults over 30

- Pathologic
  - To differentiate from physiologic, correlate with history and physical examination findings
  - Sign of poor cardiac output
  - Seen with CHF

- Caused by an increase in the volume flowing into a ventricle
  - Often related to systolic dysfunction
  - Pathologic S3 unusual in children
S4 Heart Sound

- Known as an atrial gallop
- Late diastole
- Physiologic and Pathologic
  - Physiologic
    - Virtually never seen except in exceptionally trained athletes (50% of pro basketball players, runners)

- Pathologic
  - Poor ventricular compliance
  - Long-standing hypertension, CHF, Angina, HCM

Click

- Systolic in timing
- Mid-late systolic click: MVP
- Early systolic click: Mitral stenosis
Murmur

Murmurs are often described using 7 characteristics

These help the health care professional to figure out possible causes of the murmur

Qualities of a Heart Murmur

1. Timing
   - When does it occur?
   - Systole, diastole or continuous

Heart Murmurs

- Systolic
  - MR PASS MVP
- Diastolic
  - MS ARD

Source - Fitzgerald Health Education Associates, 2012
Qualities of a Heart Murmur

2. Shape
   ■ Is there a change in the intensity of the murmur
   ■ Crescendo, decrescendo, both

3. Location
   ■ Where do you hear it loudest?

4. Radiation
   ■ Does it radiate anywhere?
   ■ Aortic-neck; mitral-axilla

5. Intensity
   ■ How loud is the murmur?
   ■ Graded on a roman numeral scale or I through VI
Intensity

- Grade I: Very faint, barely audible
- Grade II: Soft, quiet but easily heard
- Grade III: Moderately loud; no thrill
  - Murmur is as loud as S1 and S2

Intensity

- Grade IV: Loud, thrill is present
- Grade V: Very loud, thrill is present
- Grade VI: Able to be heard with stethoscope off chest; thrill is present

Qualities of a Heart Murmur

6. Pitch
   - Also called frequency
   - Low, medium or high pitched

7. Quality
   - What does the murmur sound like?
   - Blowing, musical, harsh, rumbling, humming, buzzing
Systolic Murmurs

- Mitral Regurgitation
  - Mitral valve fails to fully close
  - Allows blood to regurgitate from left ventricle to left atrium
  - Regurgitation causes a large volume overload on the left ventricle and left atrium - LAE and LVH

Mitral Regurgitation
Mitral Regurgitation

- Etiology
  - Structural abnormalities of valve
  - Leaflets of the papillary muscles, chordae tendinae, or annulus of the valve

- Ischemic Heart Disease
  - Papillary muscle necrosis

- Diseases of Connective Tissue
  - Lupus

- Rheumatic Fever
  - Only responsible for 5-15%
  - Mitral Valve Prolapse
  - Hypertrophic Cardiomyopathy
Mitral Regurgitation

■ Clinical Symptoms
  ■ Symptoms develop very slowly
  ■ Left ventricle compensates for years
  ■ Once symptoms develop, progress rapidly
  ■ Symptoms: left sided failure-sob, DOE, fatigue, edema and atrial fibrillation

Mitral Regurgitation

■ Timing: Holosystolic
■ Location: Apex
■ Radiation: Left sternal border or axilla

Mitral Regurgitation

■ Intensity: Varies
■ Pitch: Medium to high
■ Quality: Blowing (May extend beyond S2 heart sound)
Mitral Regurgitation

- Aids to diagnosis
  - If loud, often associated with a thrill
  - Unlike tricuspid regurg, it does not get louder with inspiration. It softens with full inspiration
  - Increased: have patient lay on left side, squat, handgrip
  - Decreased with valsala, standing

Mitral Regurgitation

- Associated findings
  - S1 is decreased
  - S3 may be present: this reflects volume overload on the left ventricle
  - Apical impulse is increased in amplitude and displaced downward
  - PMI may be displaced

Treatment Options

- Treatment options:
  - ACE Inhibitors
  - Hydralazine or Thiazide diuretic
  - Treat hypertension aggressively
  - Low sodium diet
  - Surgical options
  - Anticoagulant may be needed with atrial fibrillation
Physiologic Murmur

- Physiologic Murmur
  - Caused by turbulence around the valves due to a temporary increase in blood flow

Physiologic Murmur

- Etiology
  - Fever, hyperthyroidism, pregnancy, no cause
  - 50% will have a physiologic murmur at some point in life

- Timing: Early-mid systole

Physiologic Murmur

- Location: 2nd-4th interspaces of LSB; May be heart over precordium
- Radiation: Little
- Intensity: Grade I - II/VI; occasionally III/VI
- Pitch: Medium
- Quality: Soft, blowing; may occasionally be harsh
Physiologic Murmur

**Aids to Diagnosis**
- Softens or disappears with sitting or standing
- Softens or disappears with inspiration
- Increases with activity or fever

**Associated Findings**
- None unless person has anemia, pregnancy, fever, hyperthyroidism

Aortic Stenosis

- Disease in which there is progressive obstruction to left ventricular outflow
- Etiology of valvular aortic stenosis:
  - Congenital (1-30 years of age)
  - Unicuspid or bicuspid valves (40 – 60 years)
  - Rheumatic heart disease (40 – 60 years)
  - Degenerative disease (> 70 years)
Aortic Stenosis

Implications:
- LV outflow obstruction causes increase in LVH
- Increase in LV wall thickness
- Compensates for years
- Once LV function begins to decline – decrease in EF ensues
- After symptoms begin, rapid decline with a 2-3 year mortality rate of 50%

Pathophysiology of Aortic Stenosis

Due to:
- Increase in afterload pressures
- Decrease in systemic and coronary flow from obstruction which results in myocardial ischemia
- Progressive hypertrophy
- Eventually, diastolic dysfunction occurs as well
  - Due to abnormalities of relaxation and compliance
  - Important abnormality to address

Aortic Stenosis

Symptoms
- Dyspnea
- Angina
- Syncope
- Dizziness on exertion
- Dyspnea on exertion
Aortic Stenosis

- Timing: Most of systole
- Location: Right, 2nd interspace
- Radiation: Neck and down left sternal border
- Intensity: Grade II-IV/VI
- Pitch: Medium
- Quality: Harsh
- Shape: Crescendo-decrescendo
  - Sounds like: choo-choo

Aortic Stenosis

- Aids to Diagnosis
  - Have patient sit up, lean forward and listen at the end of inspiration
  - Little or no change with sitting, standing
  - Decreases with full inspiration
- Associated Findings
  - S4 may be heard; Reflects decreasing compliance in the hypertrophied left ventricle
  - Sustained and displaced apical impulse-LVH

Aortic Stenosis

- Associated Findings
  - Decreased carotid impulses
  - Displaced PMI
Treatment
- If asymptomatic without concomitant health issues, may observe
- Moderate aortic stenosis, consider reduction in weight lifting and strenuous activities
- No evidence that statins slow progression
- Treat hypertension aggressively however,
  - Slow addition of beta blocker
  - ACE/ARB often indicated
  - Caution with extreme diuresis

Mitral Valve Prolapse
- Abnormal ballooning of part of the mitral valve into the left atrium
- Affects approximately 5% of all young adults

Mitral Valve Prolapse
- Most common in women
- Murmur is that of mitral regurgitation: there is a backflow of blood from the left ventricle to left atria
Mitral Valve Prolapse

- Etiology
  - Autosomal dominant disorder
  - Can be secondary to CAD

Clinical Symptoms
- Most are asymptomatic
- Palpitations
- Pain, which is sharp or stabbing that lasts a few seconds
- Generally a benign condition
- 0-15% may go on to develop mitral regurgitation

Timing: Late systole; Occasionally holosystolic
Location: Lower left sternal border
Mitral Valve Prolapse
- Radiation: None or to axilla
- Intensity: Grade I-III/VI
  - Murmur may follow click
- Pitch: Medium
- Quality: Blowing

Mitral Valve Prolapse
- Aids to Diagnosis
  - No change in intensity with various position
  - With valsalva or standing: click moves earlier in systole – makes murmur seem longer
  - Hand grip, squat – moves further into systole: murmur is shorter

Mitral Valve Prolapse
- Associated Findings
  - Often associated with a mid-systolic click
  - Heard best at the apex
  - Click is high pitched and heard best with the diaphragm
  - S1: may be softened
  - Pectus excavatum and scoliosis
Treatment Options

- Beta blockers may be used to treat palpitations
- Low dose diuretics for fluid reduction
- Digoxin may be used in more moderate to severe disease

Sudden Cardiac Death

- From 1985 - 1995: 158 cases of sudden death during competitive exercise in the US
- This translates to 1:1,000,000 athletes
- 4 sports have been associated with more than 5 sudden deaths
  - Football, soccer, basketball, track

Mayo Clinic Study

- Significant cardiac abnormalities were found in 0.39 percent of 2,739 athletes
- 95% of all sudden deaths in athletes under 30 years of age have been due to structural heart problems
Hypertrophic Cardiomyopathy

- Most common cause of sudden cardiac death in the athlete
  - Second: Coronary Artery Abnormalities
  - Third: LVH
- A few well-known sports figures have died from this disease

Hypertrophic Cardiomyopathy

- Cardiomyopathy: disease of cardiac muscle
- Presents in young adulthood

Hypertrophic Cardiomyopathy

- Septal thickening and abnormal movements of the mitral valve; Often is accompanied by outlet obstruction
Hypertrophic Cardiomyopathy

- Etiology
  - Strong genetic component: Autosomal dominant
  - Often times, family history of individuals dying prematurely as early as in the 20’s

Clinical Symptoms

- DOE
- Often asymptomatic and die spontaneously during exercise
- Timing: Mid-systolic
- Location: Left sternal border

Radiation: Down left sternal border; occas. carotids
Intensity: Grade II and louder/VI
Hypertrophic Cardiomyopathy

- Quality: blowing, moderately harsh
- Aids to Diagnosis
  - Decreases with squatting, hand grip
  - Increases with standing, valsala

Associated Findings

- Rapid upstroke of the carotid impulse

Diastolic Murmurs
Diastolic Murmurs

- Mitral
- Stenosis
- Aortic
- Regurgitation
- Diastolic
- Diastolic murmurs are always pathologic

Source - Fitzgerald Health Education Associates, 2009

Mitral Stenosis

- Mitral Stenosis
  - Leaflets of the valve thicken and become stiff
  - Valve fails to open sufficiently

Mitral Stenosis

- Etiology
  - Rheumatic Fever: Mitral stenosis occurs in 40% of individuals with RF
  - Approximately 2/3 of patients with MS are women
  - Occurs 20 years after RF; Often in the 4th-5th decade of life
Mitral Stenosis

- Etiology
  - 7 years after onset of symptoms, it becomes severe

Mitral Stenosis

- Clinical Symptoms
  - Pulmonary Congestion - cough
  - DOE
  - SOB
  - Hemoptysis
  - Atrial fibrillation
  - Systemic Embolism

Mitral Stenosis

- Timing: Mid-Late Diastole
- Location: Apex
- Radiation: Little or none
- Intensity: Grade I - IV/VI
Mitral Stenosis

- **Pitch:** Low
  - Use a bell to auscultate
- **Quality:** Rumbling (bowling ball rolling down an alley)

Mitral Stenosis

- **Aids to Diagnosis**
  - Place bell on apical impulse
  - Have patient turn on left side: this accents murmur
  - Have patient jog in place: accents murmur
  - Louder with exhalation, immediately post valsalva, squat

Mitral Stenosis

- **Associated Findings**
  - S1 is accentuated, particularly in the mitral area
  - Opening snap may follow S2 and initiates the murmur
Treatment Options

- Patients with history of rheumatic heart disease may benefit from statin to slow progression
- Consider low dose diuretic
- Low sodium diet (decreases preload)
- Avoid significant afterload reduction as it may worsen hypotension
- Caution with beta blockers
- Monitor for atrial fibrillation

Aortic Regurgitation

- Aortic Regurgitation
  - Caused when aortic leaflets fail to close completely
  - Blood regurgitates back into the left ventricle

Aortic Regurgitation

- Etiology
  - Bacterial endocarditis is most common cause in older individual
  - In younger individual – bicuspid aortic valve
  - Rheumatic fever - 29% of all cases
  - Congenital bicuspid valve: 12%
  - Autoimmune diseases: Ankylosing spondylitis, Marfans
  - More common in men
Aortic Regurgitation

- Clinical Symptoms
  - Asymptomatic for approximately 20 years
  - DOE is often the first symptom
  - Quick progression of symptoms
  - Timing: Early-Late Diastole

Aortic Regurgitation

- Location: 2nd-4th left interspaces
- Radiation: If loud, right sternal border or apex
- Intensity: Grade I - III/VI

Aortic Regurgitation

- Pitch: High
  - Use bell to auscultate
- Quality: Blowing
  - May be mistaken for breath sounds
  - 1-2Haaaa, 1-2Haaa
Aortic Regurgitation

- **Aids to Diagnosis**
  - Heard best with patient sitting, leaning forward with breath held in exhalation
  - Increases with squatting

- **Associated Findings**
  - S3 or S4 may be present; this suggests severe disease
  - Apical pulse is often displaced laterally and downward
  - Increase in pulse pressure
  - Arterial pulses are bounding

- **Treatment Options**
  - **Chronic, Severe Aortic Regurgitation**
    - Vasodilator therapy: reduces afterload in patients with systolic hypertension to minimize wall stress and optimize LV function
    - Vasodilator therapy is indicated for long-term therapy in patients with chronic, severe AR and symptoms of LV dysfunction but who are not candidates for surgery or asymptomatic patients with severe AR and LV dilation with normal EF
References


Thank You

I Would Be Happy To Entertain Any Questions

Wendy L. Wright, MS, RN, ARNP, FNP

WendyARNP@aol.com
www.4healtheducation.com