

L4: Valvular Heart Diseases

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MEDICINE 433

objectives

1. Recognize common VHD.
- 2 . Recognize common causes of VHD.
- 3 . Know pathophysiology of different VHD.
- 4 . Diagnosis of VHD.
- 5 . Know management of common VHD.

Physiology

Understanding the heart:

The heart has four chambers - two atria and two ventricles. The walls of these chambers are mainly made of special heart muscle.

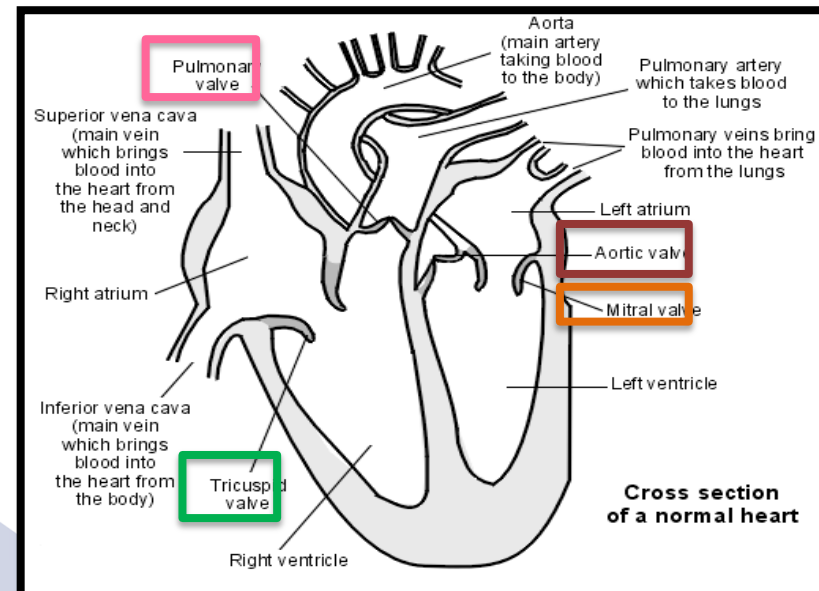
During each heartbeat both of the atria contract first to pump blood into the ventricles.

Then both ventricles contract to pump blood out of the heart into the arteries.

There are one-way valves between the atria and ventricles, and also between the ventricles and the large arteries that take blood from the heart. These are:

- **The mitral valve** - A bicuspid valve with a typical area of 4-6 cm² positioned between the left atrium & ventricle.
- **The tricuspid valve** - between the right atrium and the right ventricle.
- **The pulmonary valve** - between the right ventricle and the pulmonary artery (the main artery that takes blood from the heart to the lungs to collect oxygen).
- **The aortic valve** - It has three semi-lunar cusps valve that lies between the left ventricle and the ascending aorta. (the main artery that takes oxygen-rich blood from the heart to the body).

The valves make sure that when the atria or ventricles contract, the blood flows the correct way through the heart and into the arteries.



Review

IMPORTANT NOTICE

- #Normal area for the Aortic valve is 2-3 cm²
- #Critical narrowing < 0.7 cm²
- #Normal area for the Mitral valve is 4-6 cm²
- #Critical narrowing < 1 cm²
- #Aortic Regurgitation AR is the same as Aortic Insufficiency AI
- #Valve lesions from Pressure overload: AS & MS
- #Valve lesions from Volume overload: MR & AR

What is heart valve disease?

A valve that is diseased or damaged can affect the flow of blood through the heart. There are two main types of valve problem:

- **Valve stenosis.** This means that the opening of the valve is narrowed and **the valve does not open fully**. So, there is some restriction in blood flow through the valve.
Stenosis – Obstruction of (*forward*) flow across an *opened* valve.
- **Valve regurgitation** (sometimes called valve incompetence, or a leaky valve). This means that **the valve does not close properly** and there is backflow of blood through the leaky valve.
Regurg/ Insuff – leaking (*backflow*) of blood across a *closed* valve.

Any of the valves can be affected by these problems. However, **the mitral** and **aortic valves** are the ones that most commonly become diseased.

Normal

Systole S1-S2	AV/PV – opens
	MV/TV – closes
Diastole S2-S1	AV/PV – closes
	MV/TV – opens

Abnormal

Systole S1-S2	AV/PV – opens X → Aortic Stenosis
	MV/TV – closes X → Mitral Regurg
Diastole S2-S1	AV/PV – closes X → Aortic Regurg
	MV/TV – opens X → -Mitral Stenosis

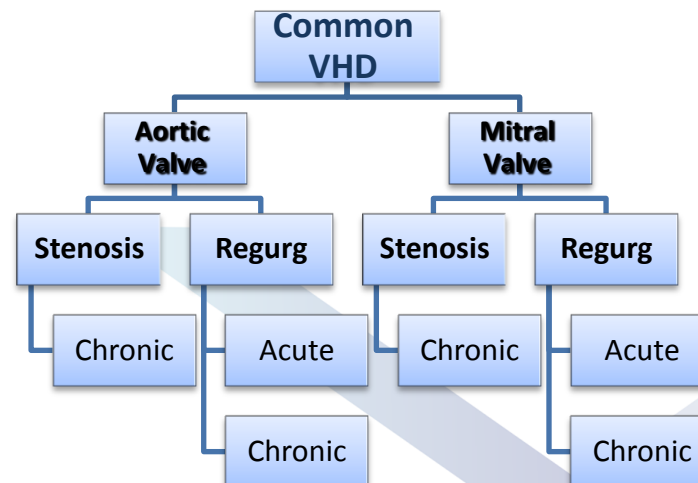
Review

On examination (valvular disease):

- 1- Abnormal look (mitral facies)
- 2- Abnormal pulse (Atrial fibrillation)
- 3- Abnormal JVP
- 4- Apex beat abnormality
- 5- Sternal or parasternal heave
- 6- Thrill (vibratory sensations caused by the heart and felt on the body surface. Always associated with murmurs)
- 7- Abnormal heart sound
- 8- MURMURS: Systolic or Diastolic .

Investigations (valvular disease):

- ECG
- CXR
- Echo cardiology: M mode, 2D, 3D, 4D, TEE, Doppler
- 24 hours monitor for heart rhythm
- MRI
- Cardiac catheterization



Common causes of VHD

Mitral Stenosis*	Mitral Regurgitation	Aortic Stenosis	Aortic Regurgitation
<p>Usually a result of rheumatic heart disease “most common cause” * Other causes include:</p> <ul style="list-style-type: none"> #Congenital Mitral Stenosis #Systemic Lupus Erythematosus #Rheumatoid Arthritis #Atrial Myxoma #Carcinoid Tumor metastasizes to the lung. #Bacterial Endocarditis #Lutembacher’s syndrome (Acquired Mitral stenosis + atrial septal defect) 	<p>the most common causes of are mitral valve prolapse, rheumatic heart disease and degenerative disease “myxomatous”. Other causes include:</p> <ul style="list-style-type: none"> #Ischemic heart diseases #Cardiomyopathy (dilated , hypertrophic) #Hypertensive heart disease #Infective endocarditis #Myocarditis #Connective tissue disorders (SLE) #Collagen abnormalities (Marfan’s syndrome) #Drugs: Centrally acting appetite suppressant eg: fenfluramine. Dopamine agonist eg: cabergoline. 	<p>1-Infants and children: congenital defects</p> <p>2-Young adults to middle aged:</p> <ul style="list-style-type: none"> o Calcification & fibrosis of a congenitally bicuspid aortic valve o Rheumatic aortic stenosis <p>3-Middle aged to elderly:</p> <ul style="list-style-type: none"> o Degenerative aortic stenosis o Rheumatic aortic stenosis o Calcification of a congenitally bicuspid aortic valve <p>#Calcific Aortic Valvular Disease:</p> <ul style="list-style-type: none"> o Commonest cause o Elderly o Inflammatory process o Risks include elevated LDL, hypertension, diabetes & smoking <p>#Bicuspid aortic valve:</p> <ul style="list-style-type: none"> o Commonest form of congenital heart disease o Associated with: aortic coarctation, root dilation & aortic dissection <p>#Rheumatic stenosis:</p> <ul style="list-style-type: none"> o Progressive fusion, thickening and calcification of the aortic valve o Aortic valve is involved in 30-40% of rheumatic heart diseases 	<p>Acute:</p> <ul style="list-style-type: none"> o Acute rheumatic fever o Infective endocarditis o Dissection of the aorta o Ruptured sinus of Valsalva aneurysm o Failure of prosthetic heart valve <p>Chronic:</p> <ul style="list-style-type: none"> o Rheumatic heart disease o Syphilis Arthritides o Reiter's syndrome o Ankylosing spondylitis o Rheumatoid arthritis o Hypertension (severe) o Bicuspid aortic valve o Aortic endocarditis o Marfan's syndrome o Osteogenesis imperfecta

! more common in women

* secondary to rheumatic fever by group A β - hemolytic streptococcus

Pathophysiology of different VHD

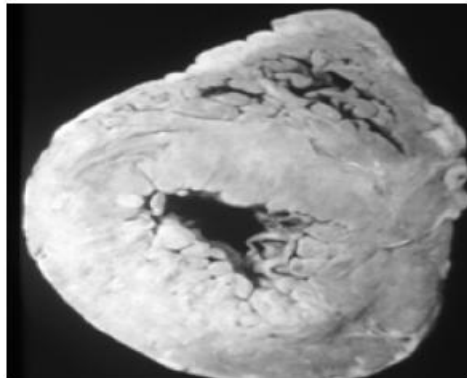
Mitral stenosis

Progressive fibrosis, calcification or fusion of the valves restricts blood flow to the left ventricle leading to a rise in left atrial pressure which in turn causes left atrial dilation and hypertrophy. Consequently, pulmonary venous and arterial pressure also increase resulting in congestion (cause of exertion dyspnea) in addition to right heart pressure. Progressive dilation commonly causes atrial fibrillation. Also could lead to tricuspid regurgitation

Aortic stenosis

Ventricular Compensation

- **Concentric hypertrophy**
 - Reduces wall stress
 - Reduces ventricular compliance
 - LVEDp increases
 - LAP increases



Mitral Regurgitation

Acute: sudden Elevation of LA pressure with normal size and compliance, results in backflow causing
 -pulmonary edema.
 -decreased cardiac output so, hypotension and shock.

Chronic: gradual elevation of LA pressure with gradual dilation of LA and LV and increased compliance of LA

Aortic Regurgitation

- **Widened pulse pressure**
 - Stroke volume increased (high SBP)
 - Regurgitant volume increased (low DBP)
- **Imbalance between myocardial supply and demand**
 - Decreased DBP = decreased perfusion pressure = decreased supply
 - Increased LV size (and thus wall stress) = increased demand

Signs & Symptoms

FROM 432 TEAMWORK

	Signs	Finding
Mitral Stenosis	Hemoptysis” because of increased pulmonary pressure”, Fatigue Orthopnea & PND Mitral facies “malar flush”	Loud S1 Tapping impulses on left parasternal side Mid-Diastolic rumbling murmur Opening snap
Mitral Regurgitation	Atypical chest pain Palpitations Fatigue Orthopnea & Paroxysmal nocturnal dyspnea	Pansystolic murmur S3 Gallop Rales mid-systolic click
Aortic Stenosis	Angina Syncope on exertion Congestive heart failure	Slow rising carotid pulse & radiate to the carotids Systolic ejection murmur Prominent S4
Aortic Regurgitation	Dyspnea on exertion Fatigue Angina	Mid-diastolic rumble at apex “radiate to the apex “ High pitched early diastolic decrescendo S3 & S4 Gallop Duroziez`s sign (femoral bruit) De Musset`s sign (head nodding with pulse)

Diagnosis of VHD

Mitral Stenosis	Mitral Regurgitation	Aortic Stenosis	Aortic Regurgitation
<p>1. CXR: Left atrial enlargement (early)</p> <p>2. Echocardiogram—most important test in confirming diagnosis</p> <ol style="list-style-type: none"> Left atrial enlargement Thick, calcified mitral valve Narrow, “fish mouth”-shaped orifice Signs of RVF if advanced disease 	<p>1. CXR: Cardiomegaly, dilated LV, pulmonary edema</p> <p>2. Echocardiogram: MR; dilated LA and LV; decreased LV function</p>	<p>1. CXR: Calcific aortic valve, enlarged LV/LA (late)</p> <p>2. ECG: LVH, LA abnormality , left bundle branch block .</p> <ol style="list-style-type: none"> Echocardiogram—diagnostic in most cases. Findings include LVH; thickened, immobile aortic valve; and dilated aortic root. <p>3. Cardiac catheterization</p> <ol style="list-style-type: none"> Definitive diagnostic test Can measure valve gradient and calculate valve area (<0.8 cm² indicates severe stenosis); normal aortic valve is 3 to 4 cm² Useful in symptomatic patients before surgery 	<p>1. CXR: LVH, dilated aorta</p> <p>2. ECG: LVH</p> <p>3. Echocardiogram—perform serially in chronic, stable patients to assess need for surgery</p> <ol style="list-style-type: none"> Assess LV size and function. Look for dilated aortic root and reversal of blood flow in aorta. In acute aortic regurgitation, look for early closure of mitral valve. <p>4. Cardiac catheterization: To assess severity of aortic regurgitation and degree of LV dysfunction</p>

Management

Mitral Stenosis	Mitral Regurgitation	Aortic Stenosis	Aortic Regurgitation
<p>1. Medical</p> <ul style="list-style-type: none"> a. Diuretics—for pulmonary congestion and edema b. Beta-blockers—to decrease heart rate and cardiac output c. Infective endocarditis prophylaxis d. Chronic anticoagulation with digoxin is indicated (especially if patient has AFib) <p>2. Surgical (for severe disease)</p> <ul style="list-style-type: none"> a. Percutaneous balloon valvuloplasty usually produces excellent results. b. Open commissurotomy and mitral valve replacement are other options if valvotomy is contraindicated. <p>3. Management</p> <ul style="list-style-type: none"> a. No therapy is required in asymptomatic patients. b. Diuretics can be used if the patient has mild symptoms. c. If symptoms are more severe, surgical treatment is recommended. d. If AFib develops at any time, treat accordingly 	<p>1. Medical</p> <ul style="list-style-type: none"> a. Afterload reduction with vasodilators is recommended for symptomatic patients only; they are not recommended in most asymptomatic patients as they may mask progression of the disease b. Chronic anticoagulation if patient has atrial fibrillation c. IABP as bridge to surgery for acute MR <p>2. Surgical</p> <ul style="list-style-type: none"> a. Mitral valve repair or replacement b. Must be performed before left ventricular function is too severely compromised 	<p>1. Medical therapy has a limited role.</p> <p>2. Surgical therapy: Aortic valve replacement is the treatment of choice. It is indicated in all symptomatic patients.</p>	<p>1. Conservative if stable and asymptomatic: Salt restriction, diuretics, vasodilators, digoxin, afterload reduction (i.e., ACE inhibitors or arterial dilators), and restriction on strenuous activity</p> <p>2. Definitive treatment is surgery (aortic valve replacement). This should be considered in symptomatic patients, or in those with significant LV dysfunction on echocardiogram.</p> <p>3. Acute AR (e.g., post-MI): Medical emergency—perform emergent aortic valve replacement!</p> <p>4. Endocarditis prophylaxis before dental and GI/genitourinary procedures</p>

Tricuspid Valve & Pulmonic Valve

Tricuspid Valve

Endocarditis

– IV drug abusers or in patients with IVs

Carcinoid HD - classically TS

TR – common, benign, may be secondary to
Pulm HTN

Pulmonic Valve

Pediatrics – Pulm Stenosis

Rheumatic HD – PI (Graham Steel Murmur)

Right sided valvular lesions change in intensity with inspiration

Exam's Qs about tricuspid and pulmonary valves will not be out of this slide

Mitral Valve Prolapse (MVP)

***Mitral Valve Prolapse (MVP):** Also known as a floppy valve (Barlow's syndrome), caused by **abnormally large valve leaflets, annulus or chordae or abnormal papillary contractions**. Also associated with: **Myxomatous valve degeneration**, Thyrotoxicosis, **Rheumatic heart disease**, **Ischemic heart disease**, Marfan's Syndrome

***Signs & Symptoms of MVP:**

- **Atypical chest pain** “left sub-mammary stabbing pain”
- Palpitations
- **Mid systolic click is the most common sign** (caused by the sudden valve prolapse & tensing of the chordae during systole)
- High risk of thromboembolism
- The most common sign is a mid-systolic click.
- Produced by the sudden prolapse of the valve and the tensing of the chordae tendineae that occurs during systole.
- A late systolic murmur owing to some regurgitation

***Treatment of MVP:**

- Beta-blockade is effective for the treatment of the atypical chest pain and palpitations.
- Mitral valve prolapse associated with significant mitral regurgitation and atrial fibrillation, anticoagulation is advised to prevent thromboembolism.
- Mitral valve prolapse associated with severe mitral regurgitation has a risk of sudden cardiac death.



IMPORTANT NOTICE

- # Mitral Stenosis Usually a result of rheumatic heart disease
- # The hallmark sign of MS is dyspnea on exertion.
- # The increased left atrial pressure in MS causes pulmonary hypertension & atrial fibrillation
- # We will not hear S4 in atrial fibrillation.
- # Echo 2D/ Doppler: TEST OF CHOICE in VHD
- # In X-ray of patient with MS will show enlarged left atrium
- # Symptoms of AS: Angina, Syncope on exertion and Congestive heart failure
- # Aortic stenosis can be diagnosed only by auscultating the carotid which characterized by LOW VOLUME & SLOW RISING PULSE
- # TS seen in carcinoid syndrome and Endocarditis in IV drug abusers
- # Tricuspid Regurgitation: The commonest right-side disease
- # TR Secondary to other diseases (functional regurgitation) usually occurs in cases of atrial dilation: cor pulmonale, myocardial infarction & pulmonary hypertension. Primary, affecting the valve (organic regurgitation), may occur in rheumatic heart disease, endocarditis, carcinoid syndrome & congenital anomalies such as Ebstein's anomaly
- # PS Usually due to a congenital defect (pediatric)

MCQs

1) Which of the following is not a finding of mitral stenosis?

A- loud S1 B- opening snap C- S3 D- Mid-Diastolic rumbling

1) What is common cause of Aortic stenosis in elderly?

A- calcific B- congenital C- Rheumatic D- Paget's disease of bone

3) Most effective medical therapy in MR and AR ?

A- ACE inhibitor B- digitalis C- diuretics D- beta blockers

4) Patient present with atypical chest pain , palpitation , lightheadness we do auscultation

And we found Mid systolic click what is the most common diagnosis ?

A- MS B- AS C- Mitral prolapse D- MR

5) Chronic mitral regurgitation causes _____ , while acute regurgitation results in _____ ?

A- Increased atrial pressure - atrial dilation
B- Pulmonary edema - little increase in atrial pressure
C- Little pressure increase - atrial dilation
D- atrial dilation – increased atrial pressure

Why balloon valvuloplasty is not routinely in patient with Aortic stenosis ?

Because the main mechanism of AS is calcification Which Is not improve by balloon.

MCQs

6) A 69-year-old woman with a history of hypertension and rheumatic heart disease in childhood presents to the clinic complaining of worsening shortness of breath with exertion, fatigue, and occasional palpitations. On physical examination, she appears in no acute distress, and her vital signs include a temperature of 37.0°C (98.6°F), blood pressure of 140/80 mm Hg, pulse rate of 80/min, respiratory rate of 12/min . Her physical examination is remarkable for mild crackles in both lung fields bilaterally, a diminished S1, and a 3/6 holosystolic murmur heard best at the apex and radiating to the axilla.

What is the most possible cause for this patient ?

- A- Mitral stenosis
- B- Mitral regurgitation
- C- Aortic stenosis
- D- Aortic regurgitation



Answers: 1-c 2-A 3-A 4-C 5-D 6-B



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*Medicine is a science of uncertainty
and an art of probability*



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