

Chapter 4

Management of Patients with Cardiovascular Disorders

Dara A. Al-Banna
2019-2020



4.3. Management of patients with Valvular Disorders

Review

valves of the heart control the flow of blood through the heart into the pulmonary artery and aorta

by opening and closing in response to the BP changes as the heart contracts and relaxes.

atrioventricular valves and semilunar valves

Atrioventricular (AV) valves

separate the atria from the ventricles

tricuspid valve

separates the right atrium from the right ventricle

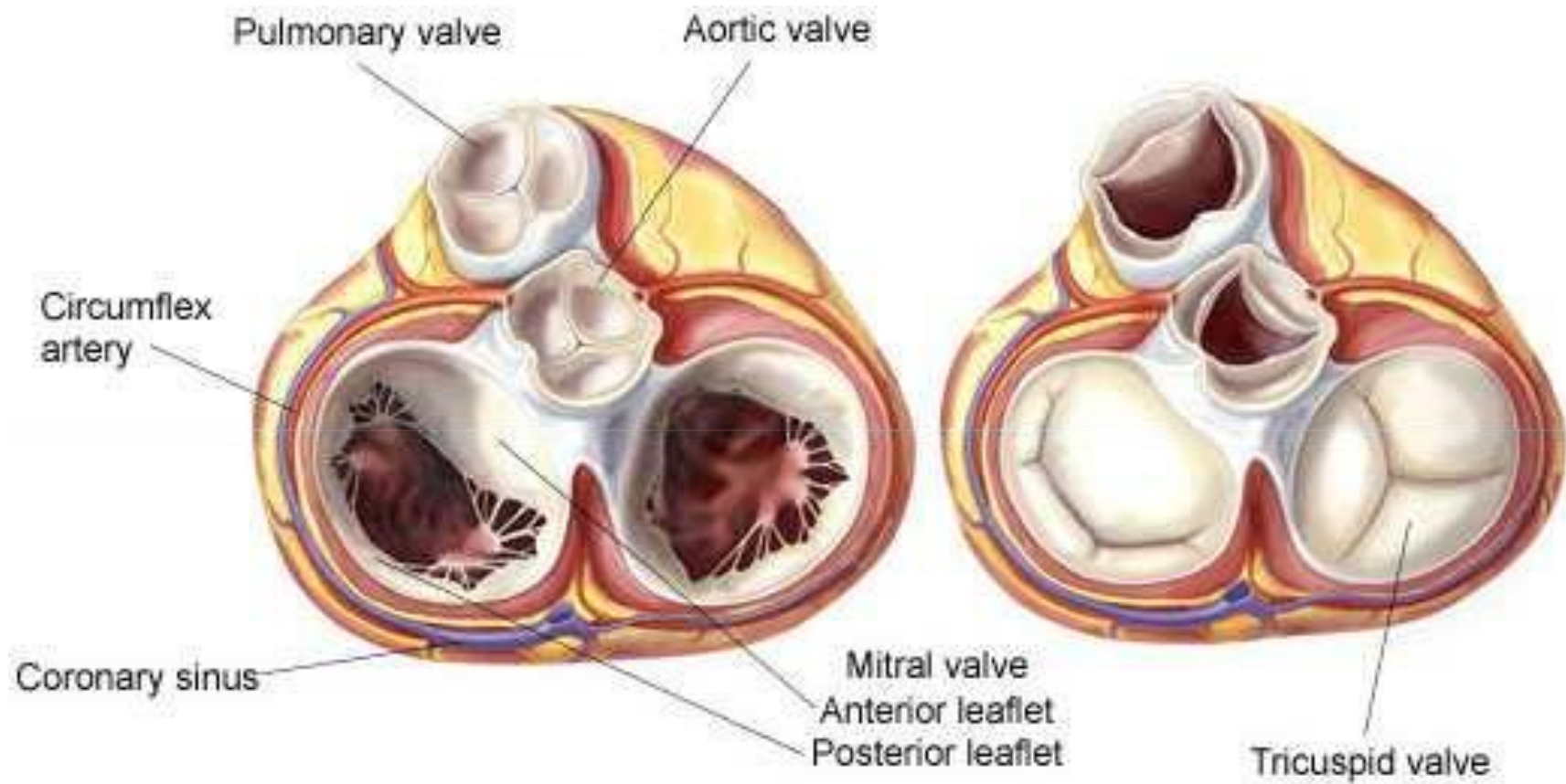
has three leaflets

mitral valve

separates the left atrium from the left ventricle

has Two leaflets

both valves have chordae tendineae that anchor the valve leaflets to the papillary muscles and ventricular wall.



semilunar valves

located between the ventricles and their corresponding arteries.

pulmonic valve

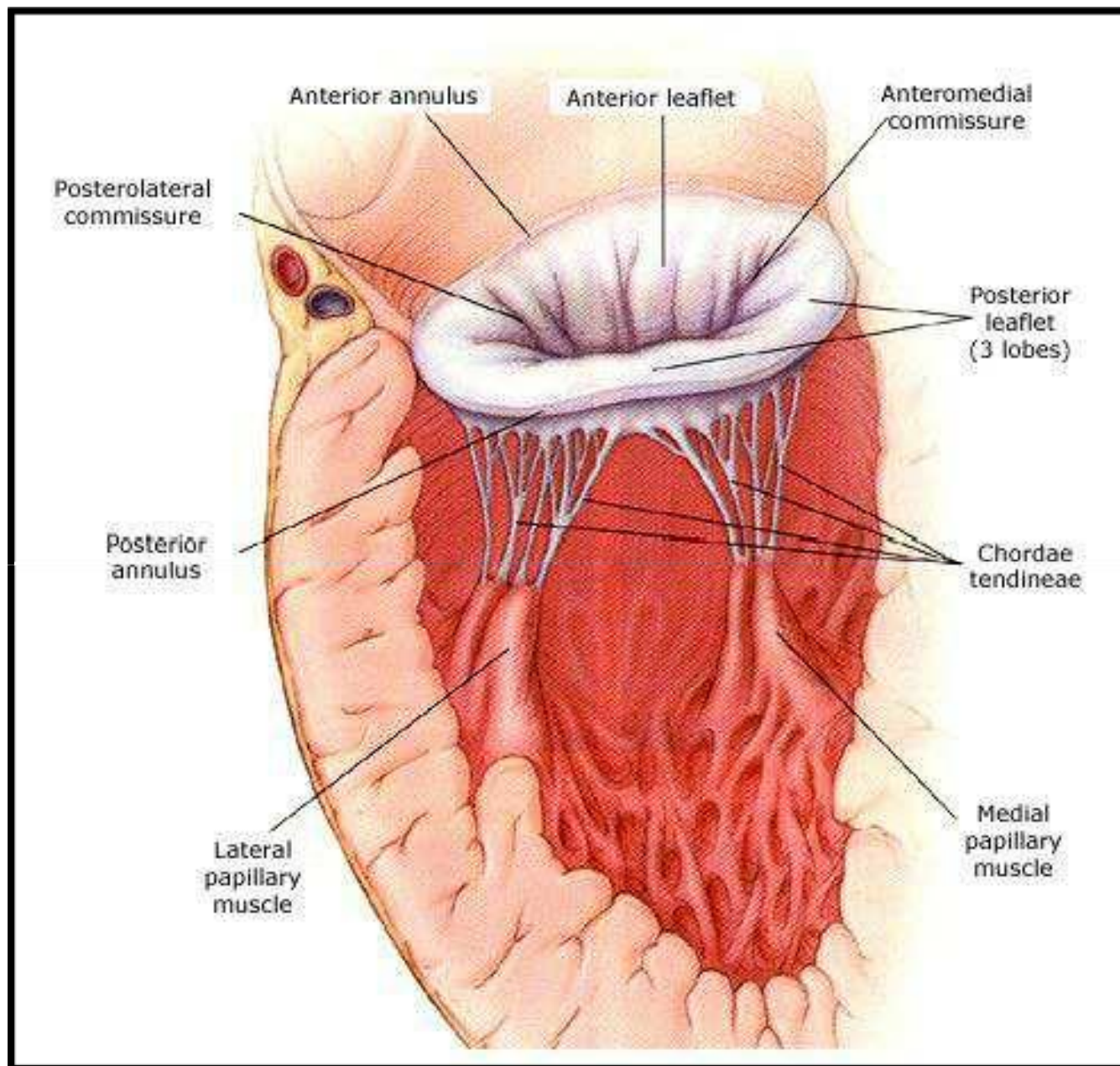
lies between right ventricle and pulmonary artery;

aortic valve

Lies between the left ventricle and the aorta

Parts of the valve





Parts of the valve

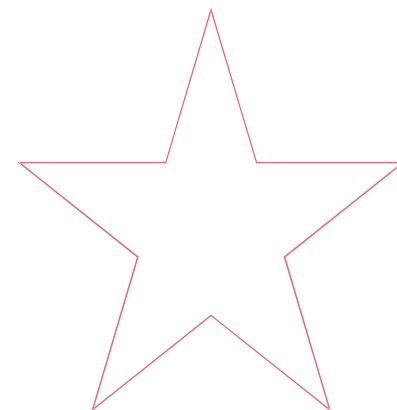
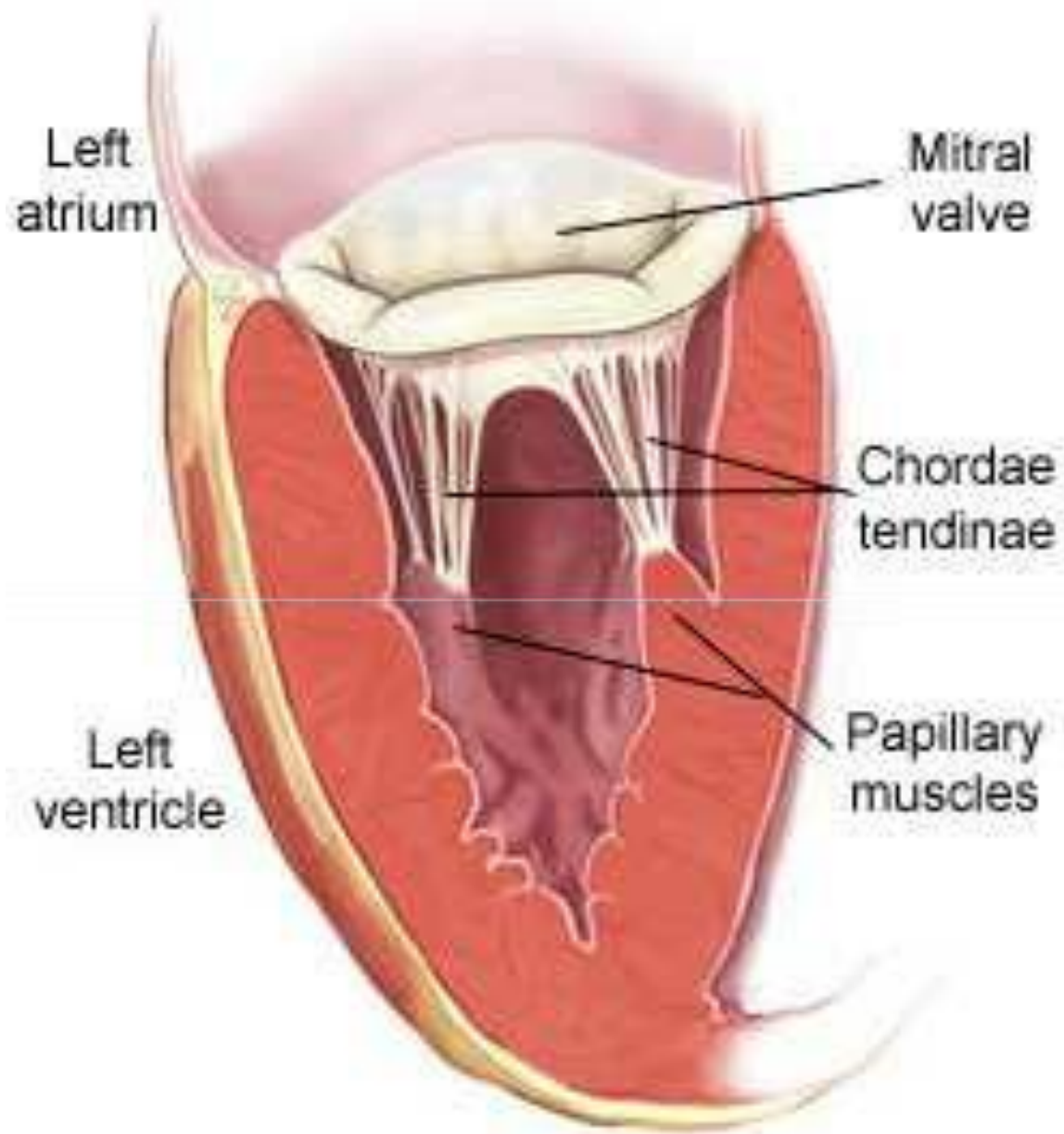
Annulus: a (fibrous) ringlike structure, or any body part that is shaped like a ring

Commissure: a site of union of corresponding parts; specifically, the sites of junction between adjacent cusps of the heart valves.

Parts of the valve

Chordae tendineae: thread-like bands of fibrous tissue that attach on one end to the edges of the tricuspid and mitral valves of the heart and on the other end to the papillary muscles.

Papillary muscles: small muscle within the heart that anchors the heart valves.



Valve Disorders

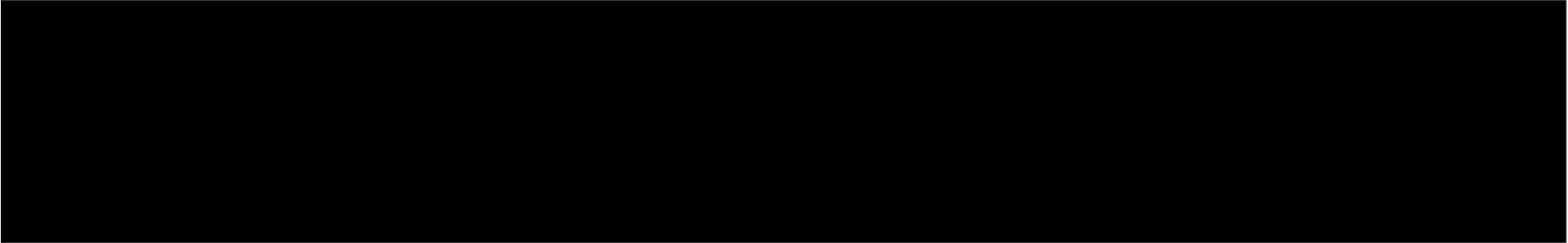
DISORDERS OF THE MITRAL VALVE

mitral valve prolapse
mitral regurgitation
mitral stenosis

DISORDERS OF THE AORTIC VALVE

aortic regurgitation
aortic stenosis

Tricuspid and pulmonic valve disorders
usually with fewer symptoms and complications.



lead to various symptoms that, depending on their severity, may require surgical repair or replacement of the valve to correct the problem

Regurgitation and stenosis may occur at the same time in the same or different valves.

Valvular Heart Disease

Valvular Heart Disease

Valvular stenosis

Valvular insufficiency

Valvular Heart Disease

Valvular stenosis

impedance of blood flow

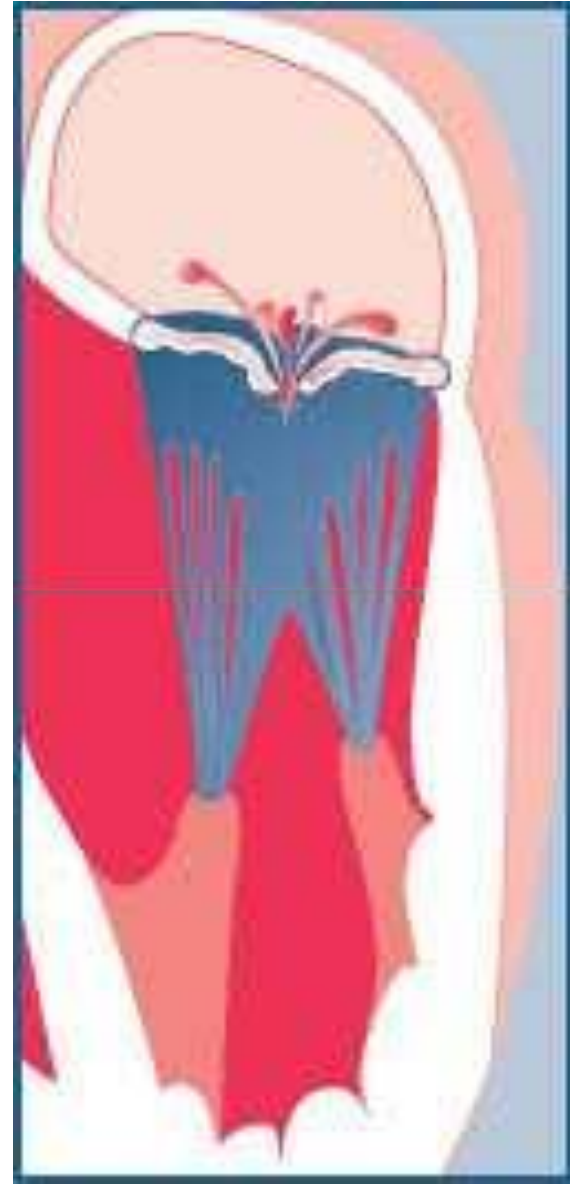
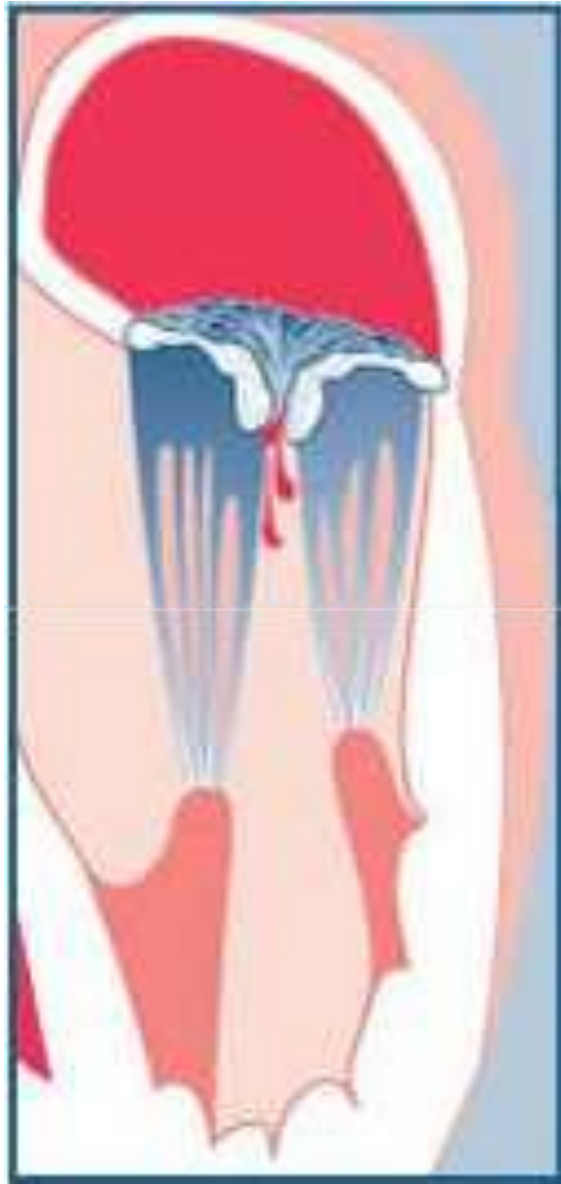
the tissues forming the valve leaflets become stiffer, narrowing the valve opening and reducing the amount of blood that can flow through it. If the narrowing is mild, the overall functioning of the heart may not be reduced

Valvular Heart Disease

Valvular insufficiency

Aka: regurgitation, incompetence, "leaky valve"
occurs when the leaflets do not close completely,
letting blood leak backward across the valve.

This backward flow is referred to as "regurgitant flow."



Types of Valvular Heart Disease

Mitral Valve Prolapse
Mitral Regurgitation
Mitral Valve Stenosis
Aortic Regurgitation
Aortic Stenosis
Tricuspid Regurgitation

Stenosis

Mitral stenosis

Progressive thickening and contracture of valve cusps with narrowing of the orifice and progressive obstruction to blood flow

Aortic stenosis

Narrowing of orifice between LV and aorta

Tricuspid stenosis

Narrowing of tricuspid valve orifice due to commissural fusion and fibrosis

Regurgitation

Mitral insufficiency (regurgitation)

Incomplete closure of the mitral valve during systole, allowing blood to flow back into LA

Aortic insufficiency (regurgitation)

Valve flaps fail to completely seal the aortic orifice during diastole and thus permit backflow of blood from aorta into LV

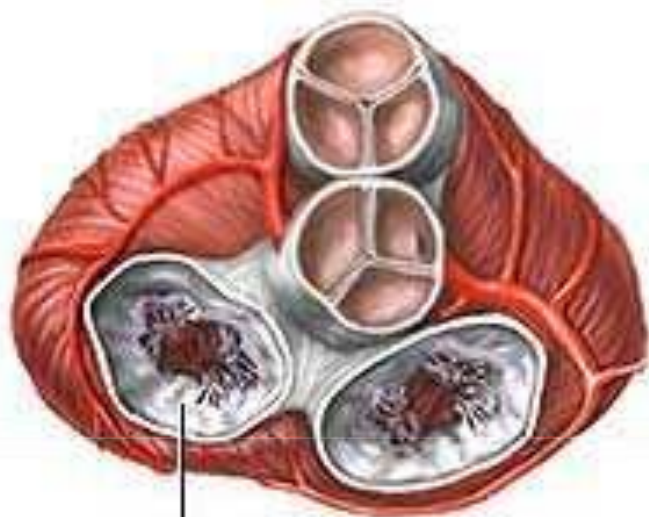
Tricuspid insufficiency (regurgitation)

Allows regurgitation of blood from RV into the RA during systole

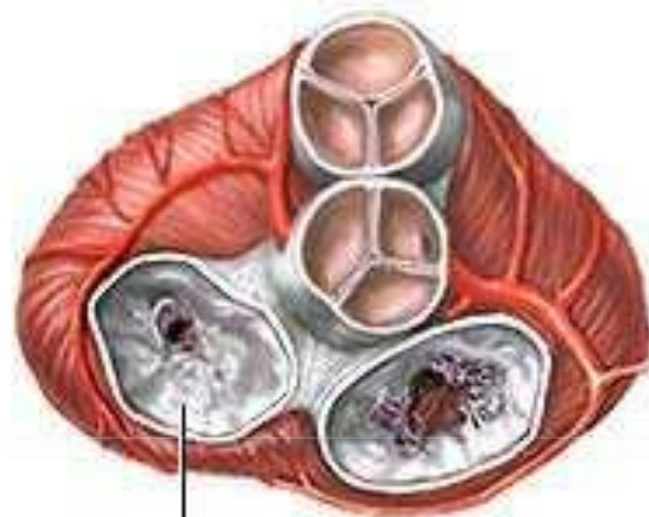
Mitral Valve Stenosis

Mitral stenosis

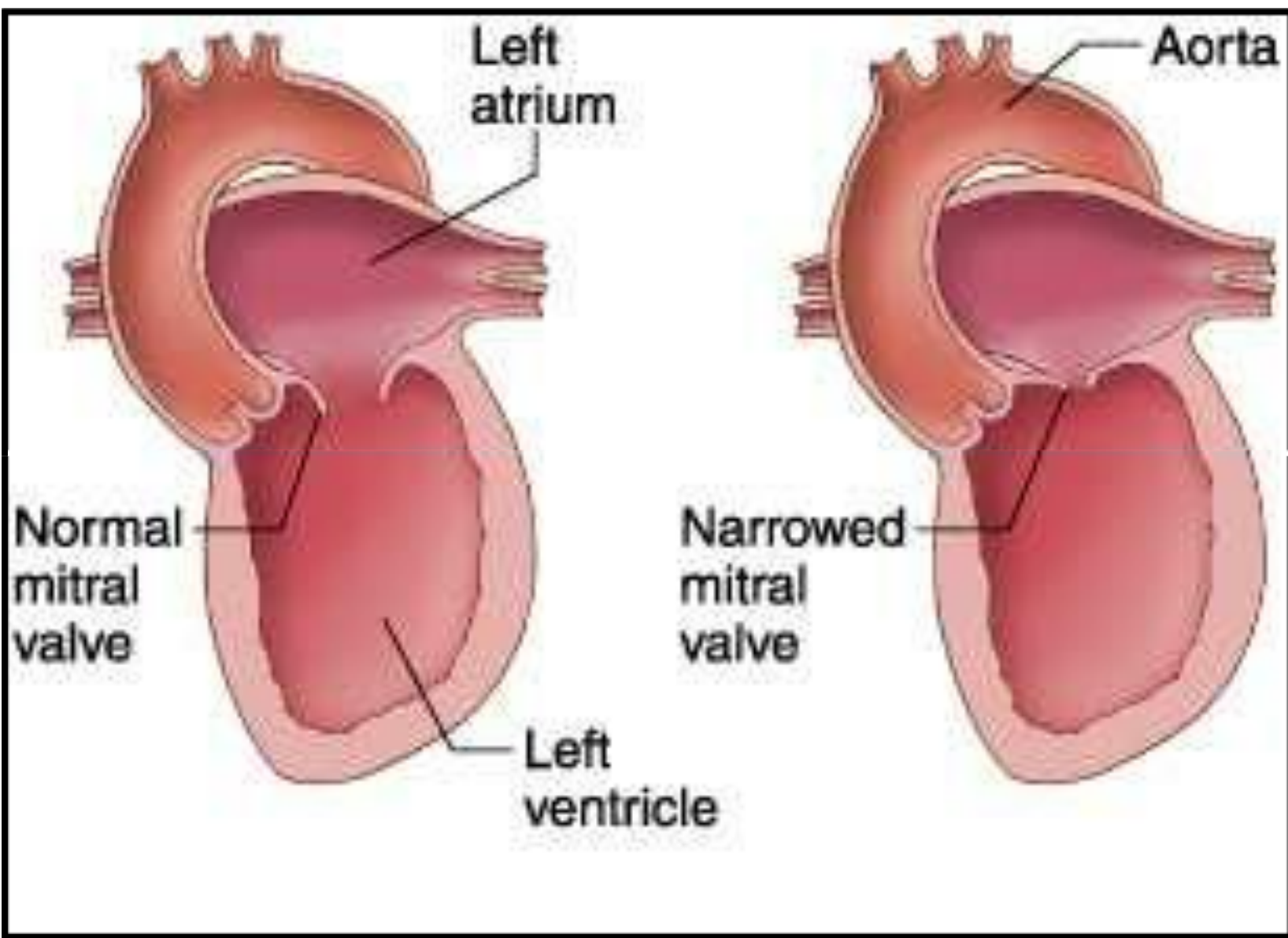
an obstruction of blood flowing from the left atrium into the left ventricle.



Normal
mitral valve



Narrowing of
mitral valve
(mitral valve stenosis)



Mitral Stenosis

most common cause

rheumatic valvulitis

rheumatic endocarditis

other causes

malignant carcinoid, SLE, RA

Pathophysiology

causes

progressively thickens the mitral valve leaflets and chordae tendineae.

The leaflets often fuse (glued) together.

Eventually, the mitral valve orifice narrows and progressively obstructs blood flow into the ventricle.

Pathophysiology

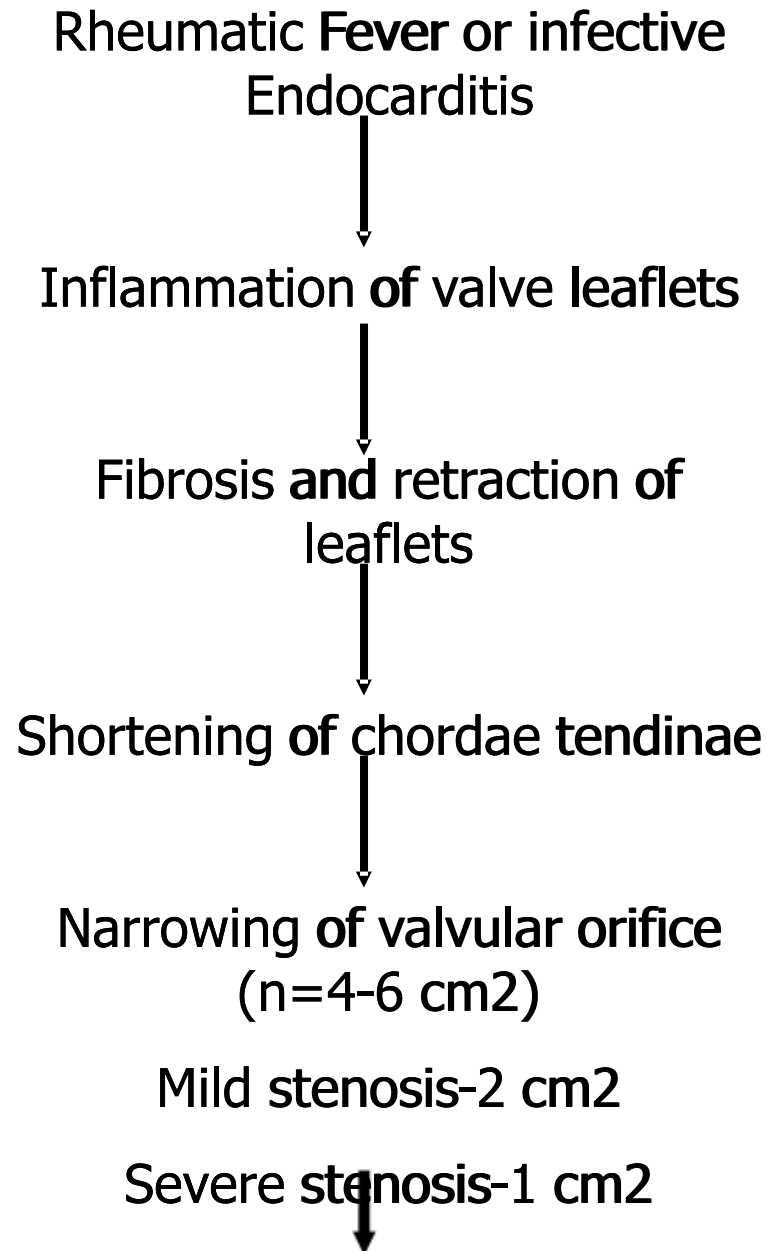
Normally, the mitral valve opening is as wide as the diameter of three fingers.

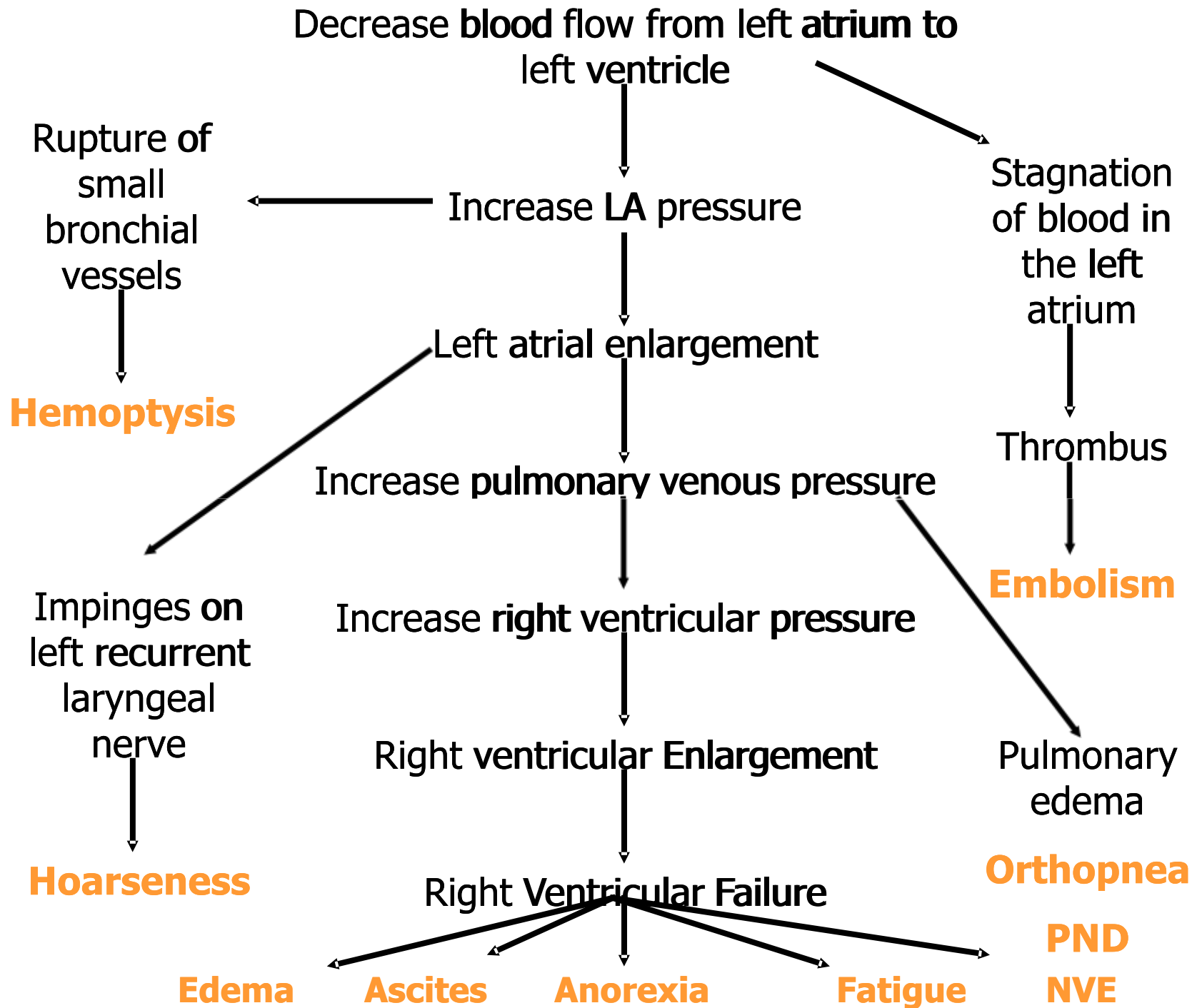
In cases of marked stenosis, the opening narrows to the width of a pencil.

Bcoz of increased resistance of the narrowed orifice; it dilates (stretches) and hypertrophies (thickens) bcoz of increased blood volume it holds
no valve to protect the pulmonary veins from the backward flow of blood from the atrium, the pulmonary circulation becomes congested.

RV - must contract against abnormally high pulmonary arterial pressure (PAP) and is subjected to excessive strain.
right ventricle fail

Pathophysiology





Clinical Manifestations

HF s/s

Dyspnea on exertion

- first symptom
- due to pulmonary venous hypertension

progressive fatigue

- as a result of low CO

Hemoptysis

cough

repeated respiratory infections

Assessment

pulse - weak , irregular

Increase intensity of S₁

diastolic rumble/ diastolic murmur
low-pitched, rumbling, heard at the apex

Opening snap after S₂- apex

heart murmurs heard during *diastole*.

start at or after S₂ and end before or at S₁.

result of the increased blood volume and pressure,
the atrium dilates, hypertrophies, and becomes

electrically unstable
atrial dysrhythmias



Diagnostic Findings

Echocardiography

- used to diagnose mitral stenosis

- used to determine the severity

Electrocardiography (ECG)

- cardiac catheterization with angiography

Medical Management

Antibiotic prophylaxis therapy
to prevent recurrence of infections

Treat CHF

Anticoagulants

to decrease the risk developing atrial thrombus

Treat anemia

Surgical intervention

Valvuloplasty

Closed Mitral commissurotomy or valvotomy

Open mitral commissurotomy or valvotomy

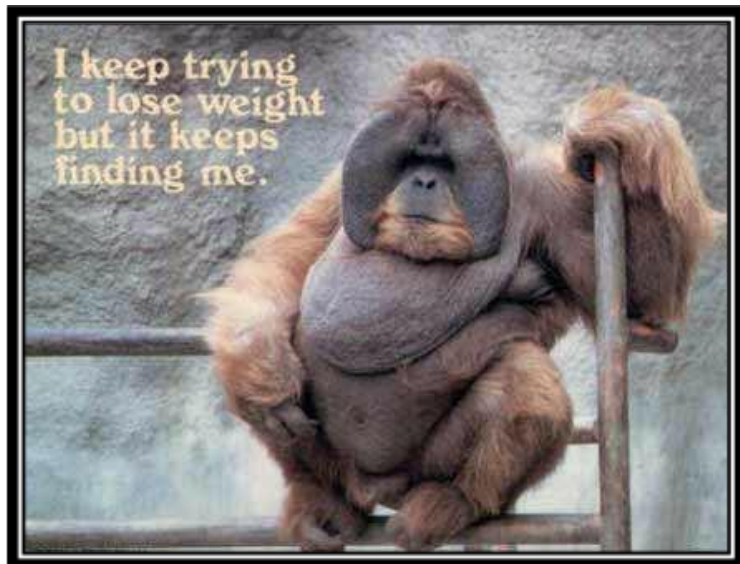
- to open or rupture the fused commissures of the mitral valve.

Percutaneous transluminal valvuloplasty /

Balloon valvuloplasty

Mitral valve replacement

Mitral Regurgitation



MITRAL REGURGITATION

involves blood flowing back from the left ventricle into the left atrium during systole. Often, the margins of the mitral valve cannot close during systole.

Pathophysiology

may be caused by **problems with**
one or more of the **leaflets** : shorten or tear
chordae tendineae : elongate, shorten, or tear
Annulus : stretched by heart enlargement or
deformed by calcification

Pathophysiology

may be caused by **problems with papillary muscles**: rupture, stretch, or be pulled out of position by changes in the ventricular wall (e.g., scar from a myocardial infarction or ventricular dilation). papillary muscle may be unable to contract because of ischemia.

Pathophysiology

Regardless of the cause blood regurgitates back into the atrium during systole. With each beat of LV, some of blood is forced back into the atrium. Because this blood is added to the blood that is beginning to flow in from the lungs, LA must stretch. It eventually hypertrophies and dilates.

The backward flow of blood from the ventricle diminishes the volume of blood flowing into the atrium from the lungs.

As a result, the lungs become congested, eventually adding extra strain on the right ventricle.

Mitral regurgitation ultimately involves the lungs and RV

Causes

Due to myxomatous degeneration, which causes stretching of the leaflets and chordae tendineae

Chronic RHD

CAD

Infective endocarditis

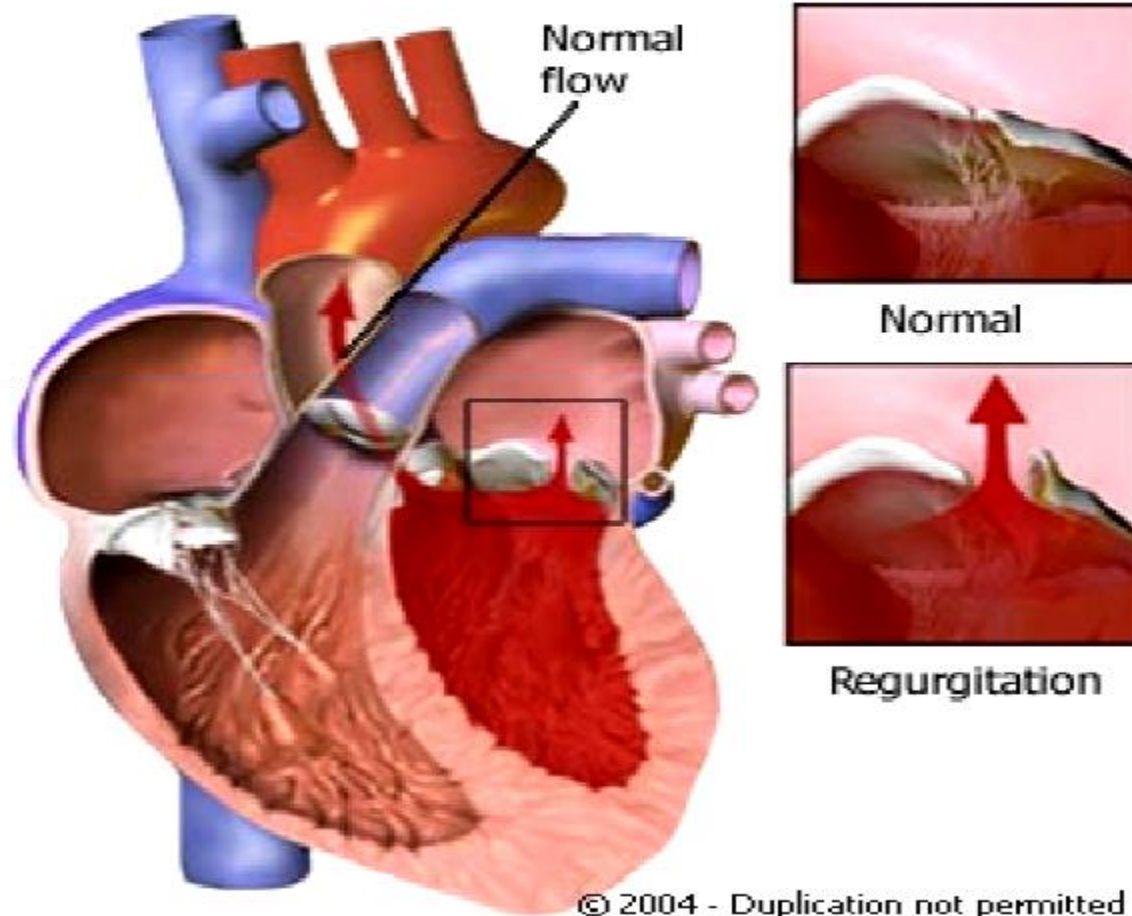
Meds and penetrating and nonpenetrating trauma



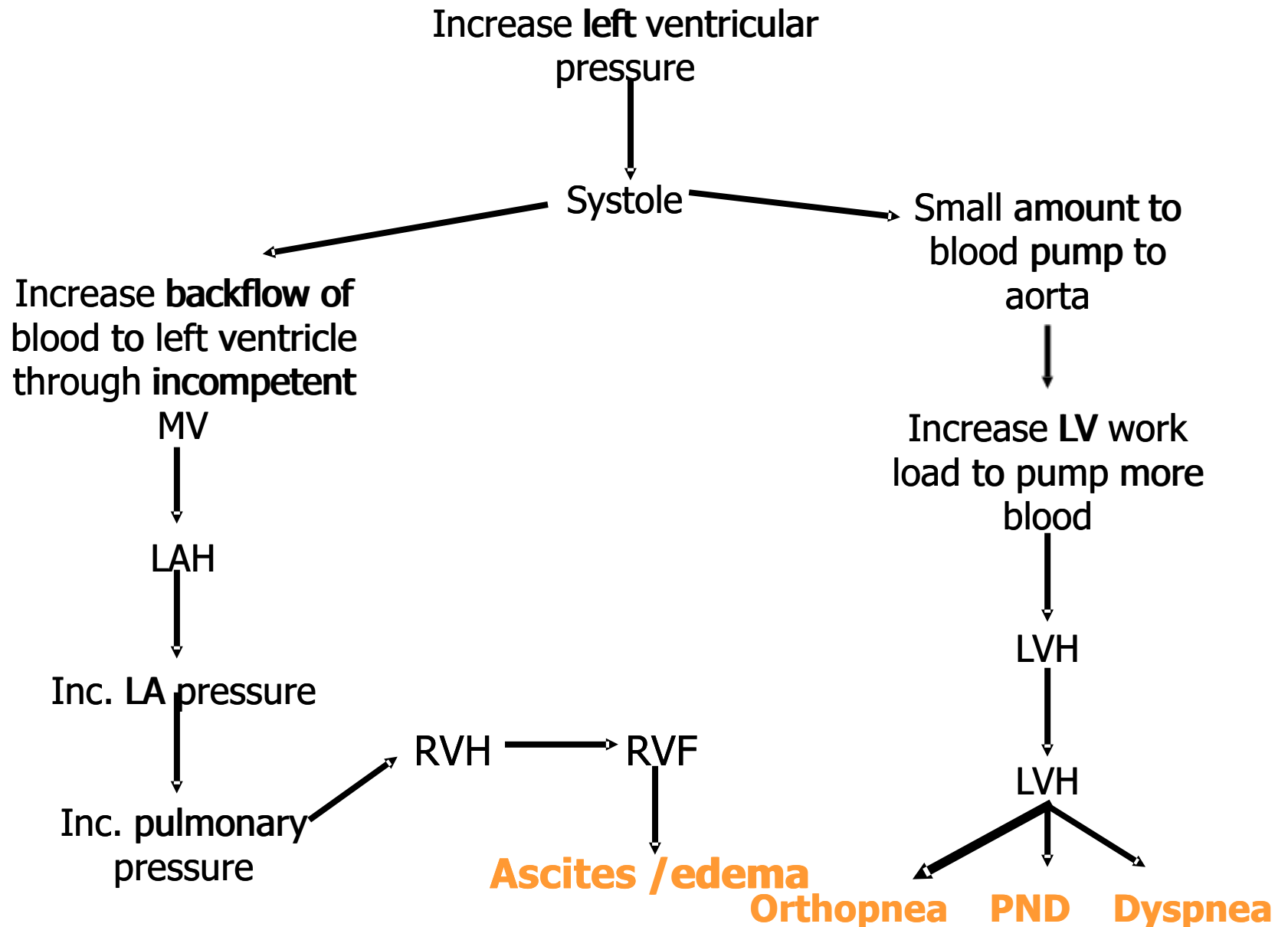
Mitral Valve Regurgitation ana phy.flv

Valvular Regurgitation

A condition in which blood leaks in the wrong direction because one or more heart valves closes improperly. Mitral valve prolapse (illustrated here) is a common cause of regurgitation.



Pathophysiology



Clinical Manifestations

Chronic mitral regurgitation - often asymptomatic

Acute mitral regurgitation (e.g., that resulting from a myocardial infarction)

manifests as severe CHF

Dyspnea, fatigue, and weakness

Palpitations, SOB on exertion, and cough from pulmonary congestion also occur.

Clinical Manifestations

Holosystolic or pansystolic murmur 5 Holosystolic Murmur.flv

a high-pitched, blowing sound at the apex.

heard best at the apex and radiates to the axilla and usually accompanied by a thrill

a heart murmur occurring throughout systole.

Pulse - regular and of good volume, or it may be irregular as a result of extrasystolic beats or atrial fibrillation.

Dx

Echocardiography
used to diagnose
monitor the progression

Medical Management

CHF MGMT

Digitalis

Diuretics

Vasodilators

Diet

Anticoagulants

SURGICAL INTERVENTION

Mitral valve
replacement
Valvuloplasty
(annuloplasty)

Mitral Valve Regurgitation treatment.flv

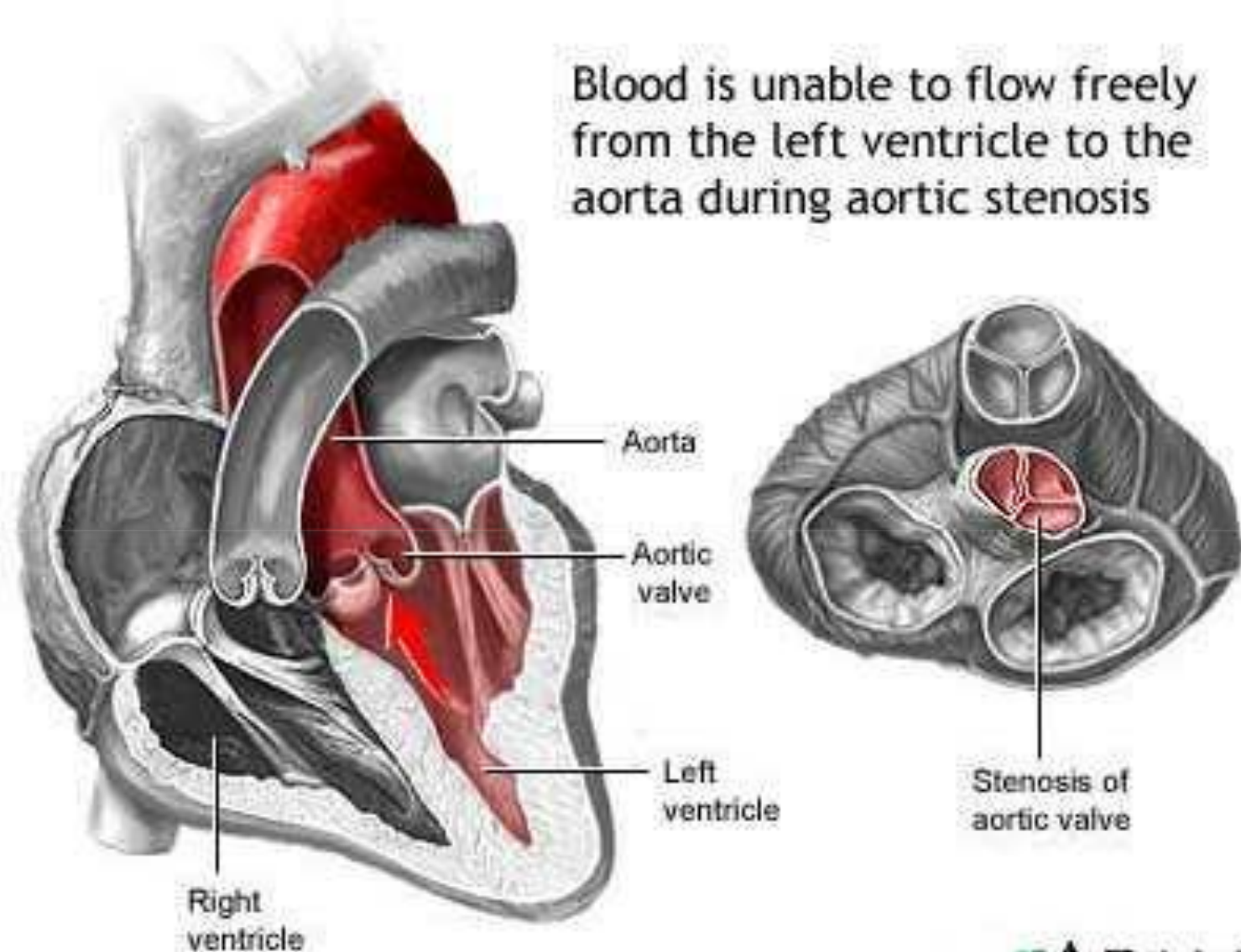
AORTIC STENOSIS

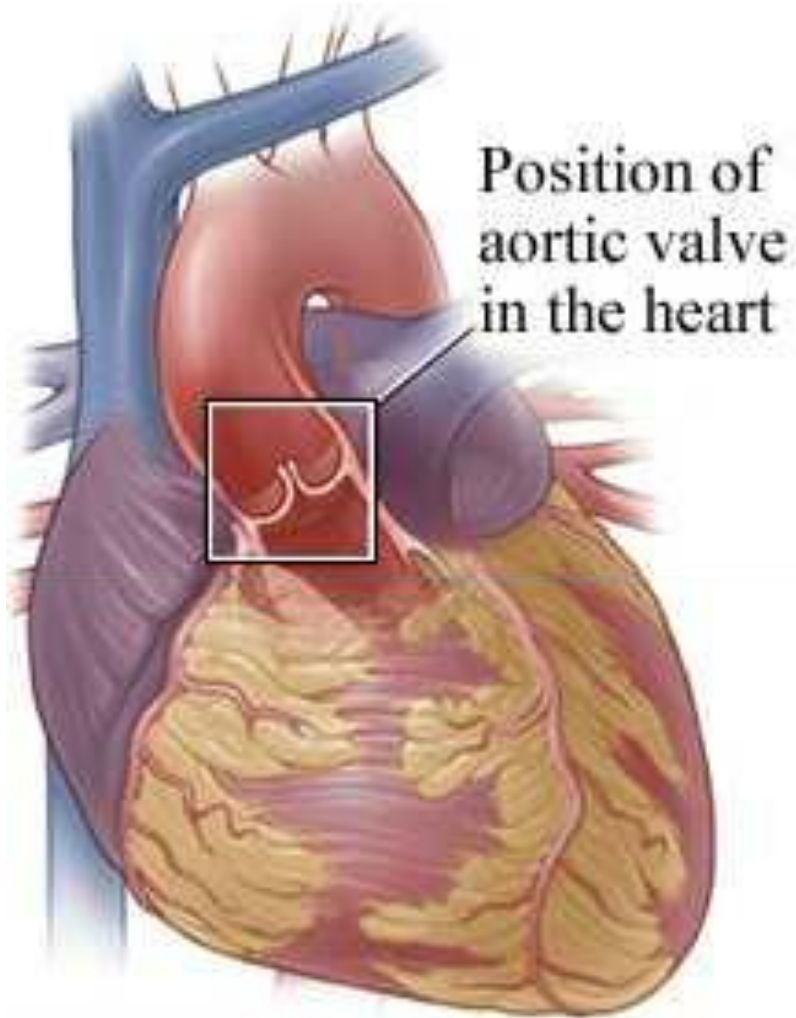
AORTIC STENOSIS

is narrowing of the orifice between the LV and the aorta.

leaflets of aortic valve may fuse.

Blood is unable to flow freely from the left ventricle to the aorta during aortic stenosis





© Healthwise, Incorporated

Normal aortic
valve



Open



Closed

Aortic valve
stenosis



Open



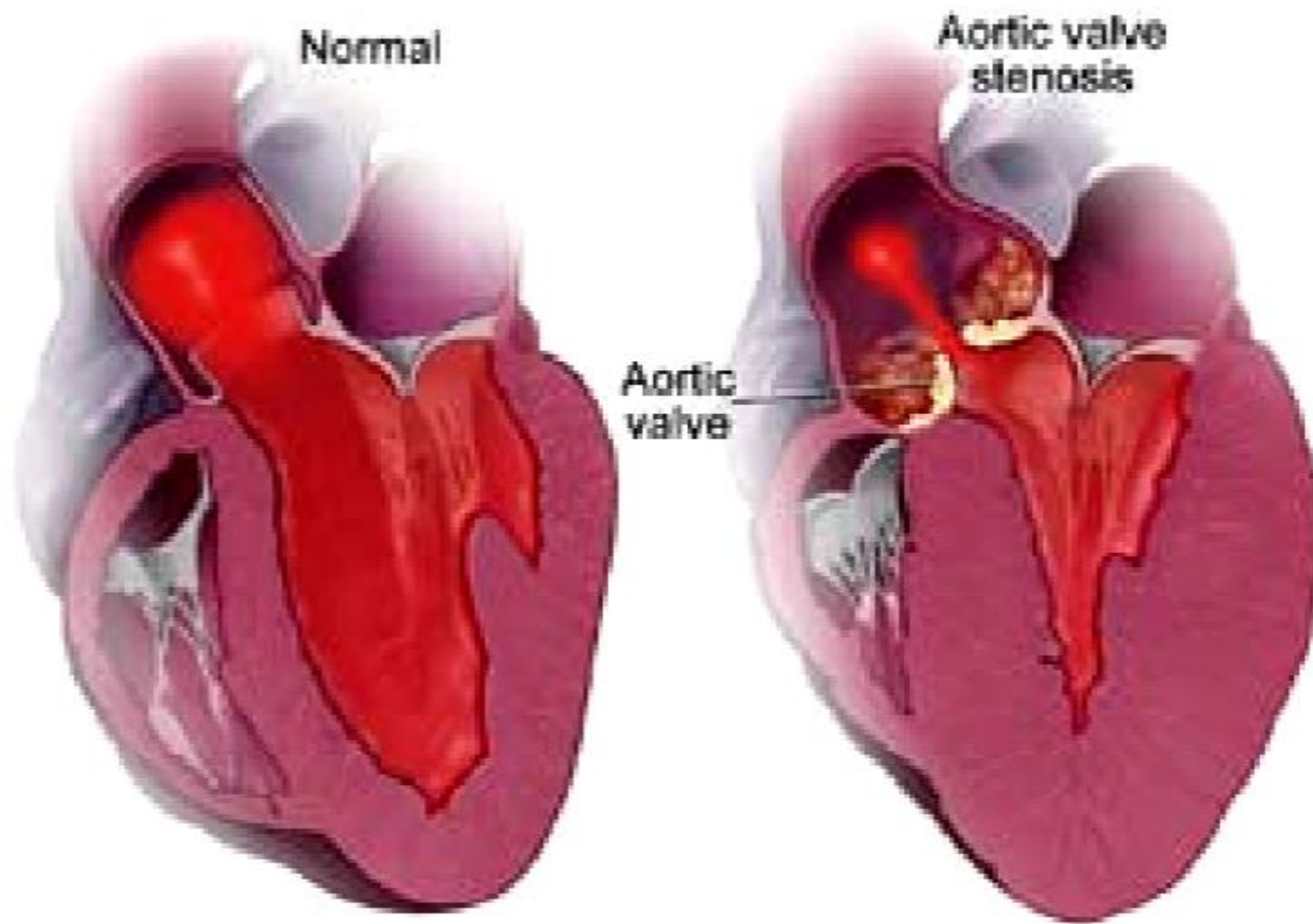
Closed

Cause

congenital leaflet malformations
abnormal number of leaflets (i.e., one or two
rather than three)
rheumatic endocarditis
RF
cusp calcification of unknown cause

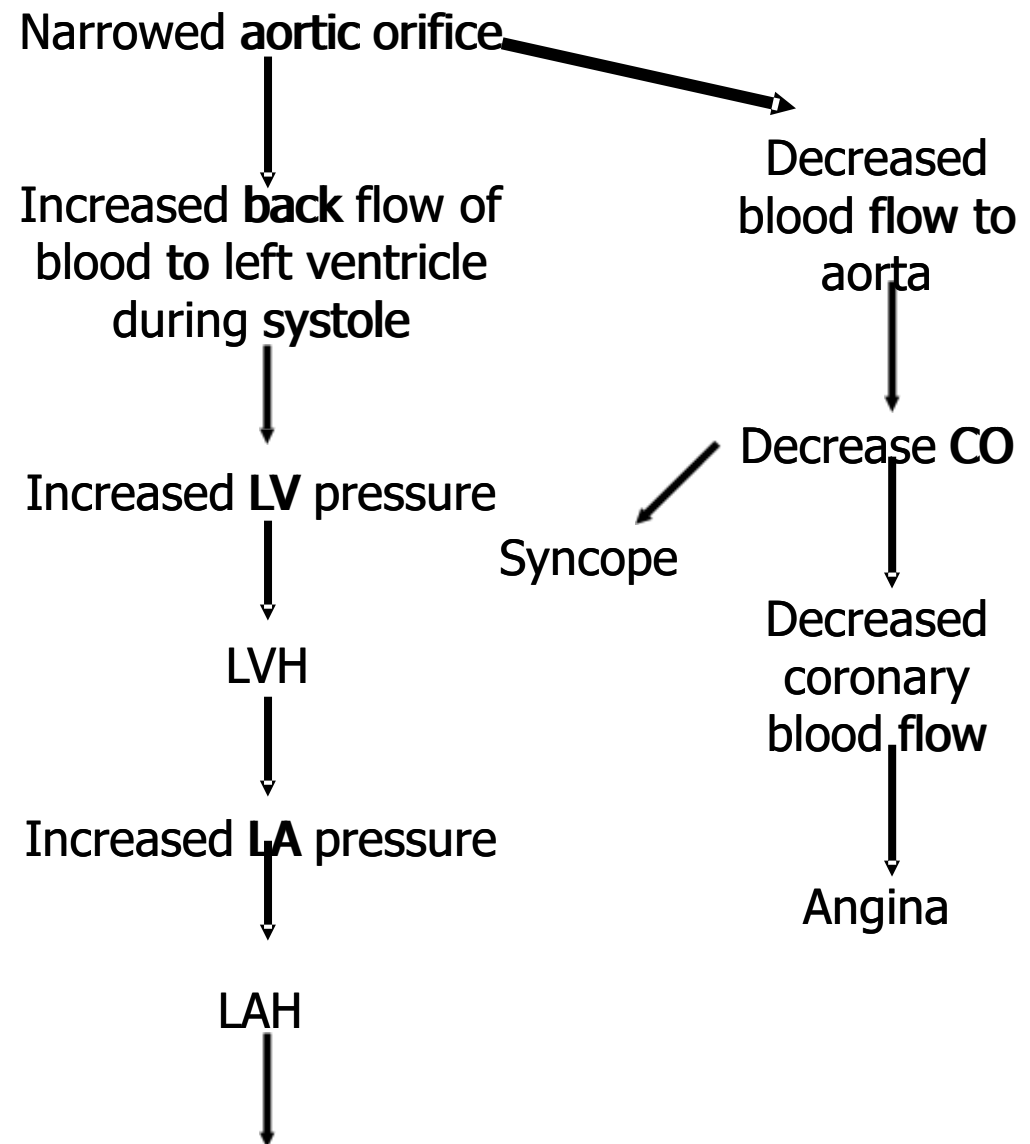
Pathophysiology

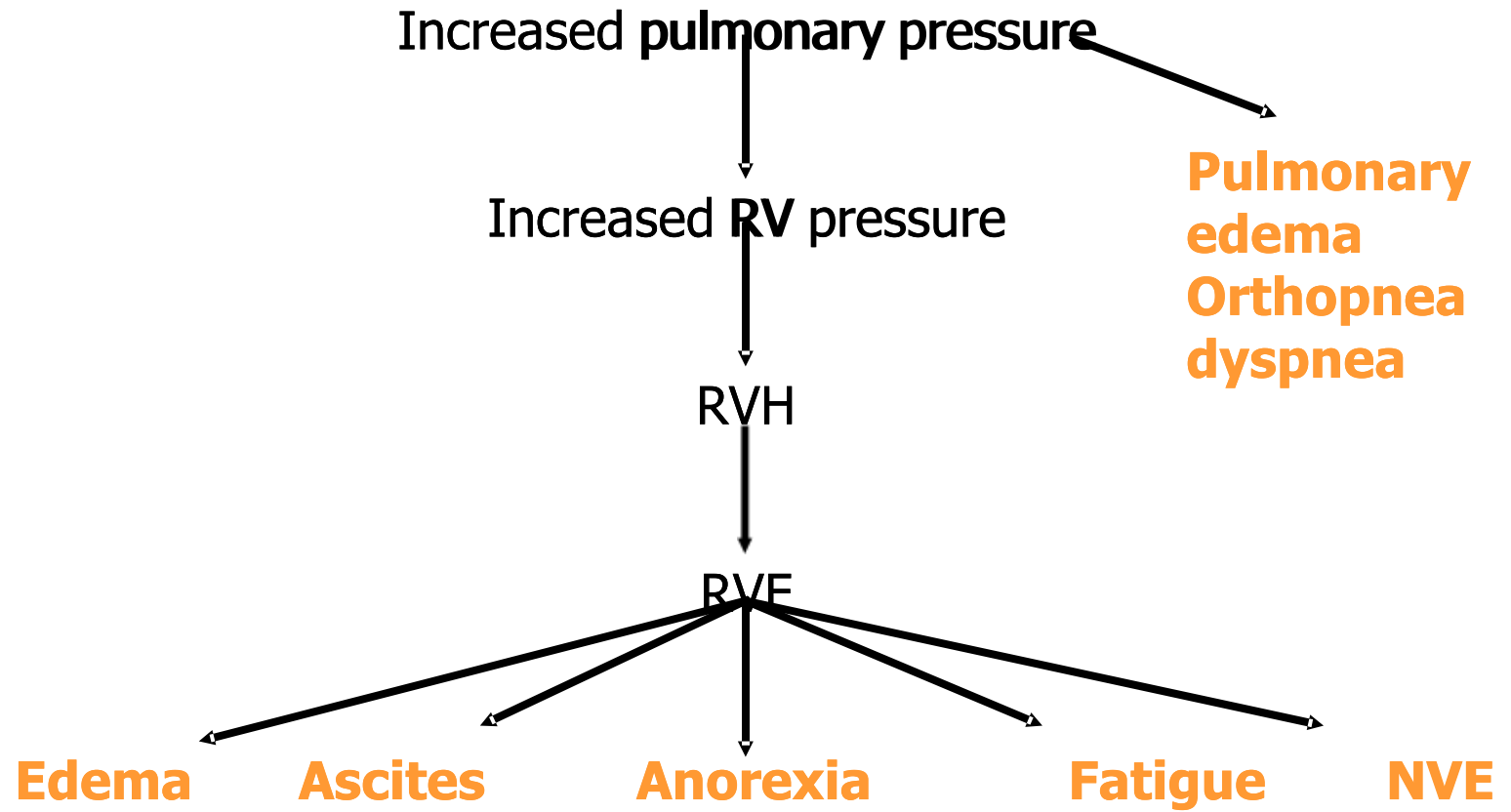
progressive narrowing of the valve orifice,
usually over a period of several years to several decades.
LV overcomes the obstruction to circulation by
contracting more slowly but with greater energy than
normal, forcibly squeezing the blood through the very
small orifice.
obstruction to LV outflow increases pressure on the
left ventricle, which results in thickening of the muscle
wall.
heart muscle hypertrophies.
When these compensatory mechanisms of the heart
begin to fail, clinical signs and symptoms develop.



Aortic Stenosis

Pathophysiology





Clinical Manifestations

Many asymptomatic
exertional dyspnea
caused by LVF

Other signs are dizziness and syncope because of reduced blood
flow to the brain

Angina pectoris

a frequent symptom

results from the increased oxygen demands of the
hypertrophied left ventricle, the decreased time in diastole for
myocardial perfusion, and the decreased blood flow into the

coronary arteries
BP - can be low but usually normal

low pulse pressure (30 mm Hg or less)
because of diminished blood flow

Assessment

systolic murmur

loud, rough systolic murmur

low-pitched, rough, rasping, and vibrating

heard over the aortic area (R upper sternal border)

may radiate into the carotid arteries and to the apex of LV

Assessment

Thrill/ Vibration

Palpated over base of heart/ 2nd RICS
caused by turbulent blood flow across the
narrowed valve orifice.

Gallavardin phenomenon

murmur also reflected to mitral area which may give a
false impression of a mitral regurgitation

Diagnostic Findings

12-lead ECG and echocardiogram

Evidence of LV hypertrophy may be seen

Echocardiography (2D echo)

used to diagnose and monitor the progression of aortic stenosis.

left-sided heart catheterization

measure the severity of the aortic stenosis and evaluate the coronary arteries.

Pressure tracings are taken from LV and base of aorta. systolic pressure in LV is considerably higher than that in the aorta during systole.

AORTIC REGURGITATION

AORTIC REGURGITATION

is the flow of blood back into the left ventricle from the aorta during diastole.

may be caused by inflammatory lesions that deform the leaflets of the aortic valve, preventing them from completely closing the aortic valve orifice.

Causes

endocarditis

rheumatic heart disease (RHD)

congenital abnormalities (e.g., marfan syndrome)

Syphilis - may produce aortitis

dissecting aneurysm

causes dilation or tearing of the ascending aorta

deterioration of an aortic valve replacement

Pathophysiology

blood from the aorta returns to the LV during diastole
in addition to the blood normally delivered by the LA

LV dilates

trying to accommodate the increased volume of blood.

LV hypertrophies

trying to increase muscle strength to expel more blood
with above normal force—raising systolic BP.

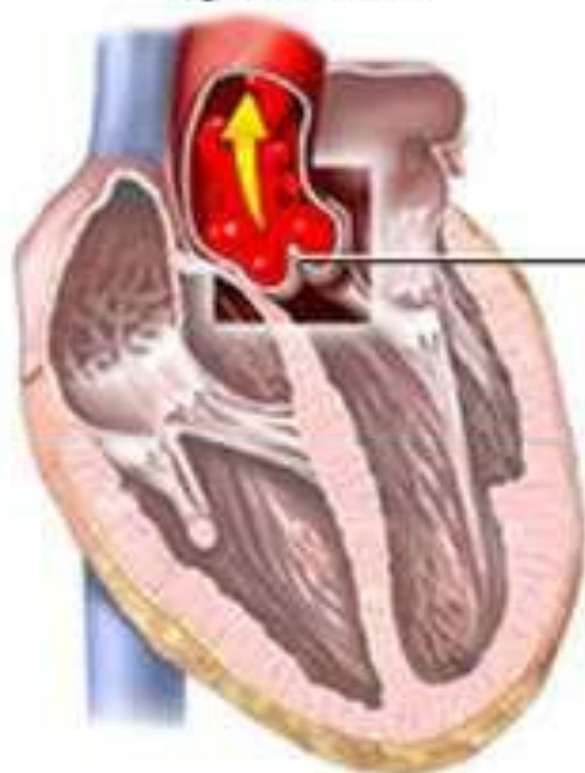
reflex vasodilation

arteries attempt to compensate for the higher pressures

peripheral arterioles relax

reducing peripheral resistance and diastolic BP.

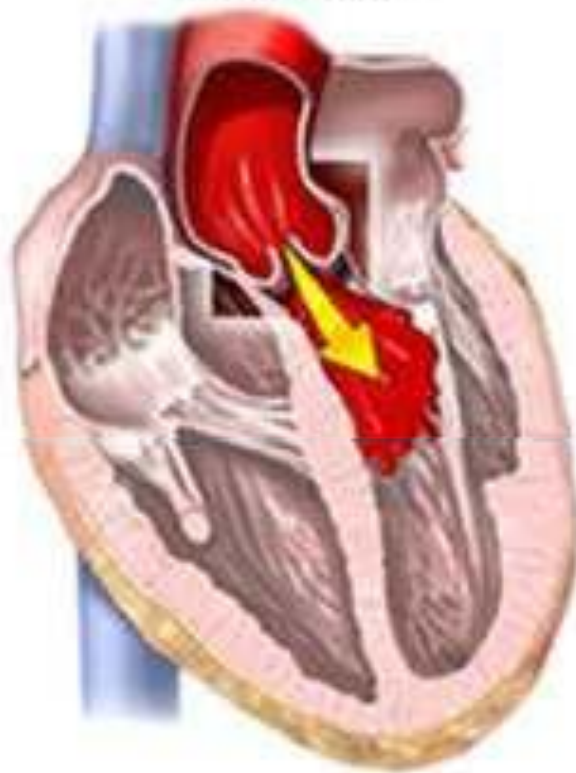
Normal valve
operation



Aortic
valve

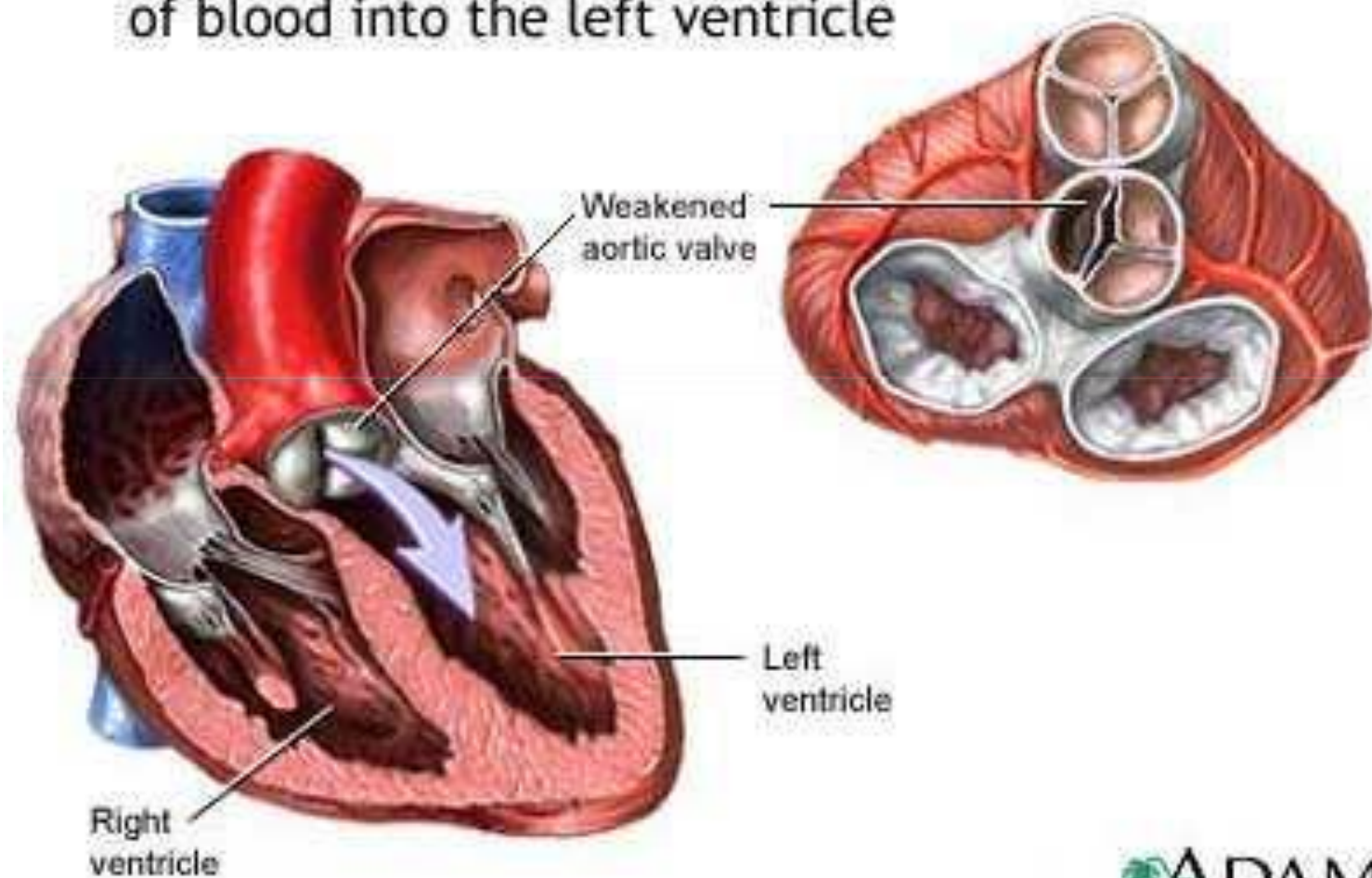
Valve closes after
left ventricle pumps
blood into aorta

Leakage
of valve



Valve does not close
completely, leaking
blood into heart

Failure of the aortic valve to close tightly causes back flow of blood into the left ventricle



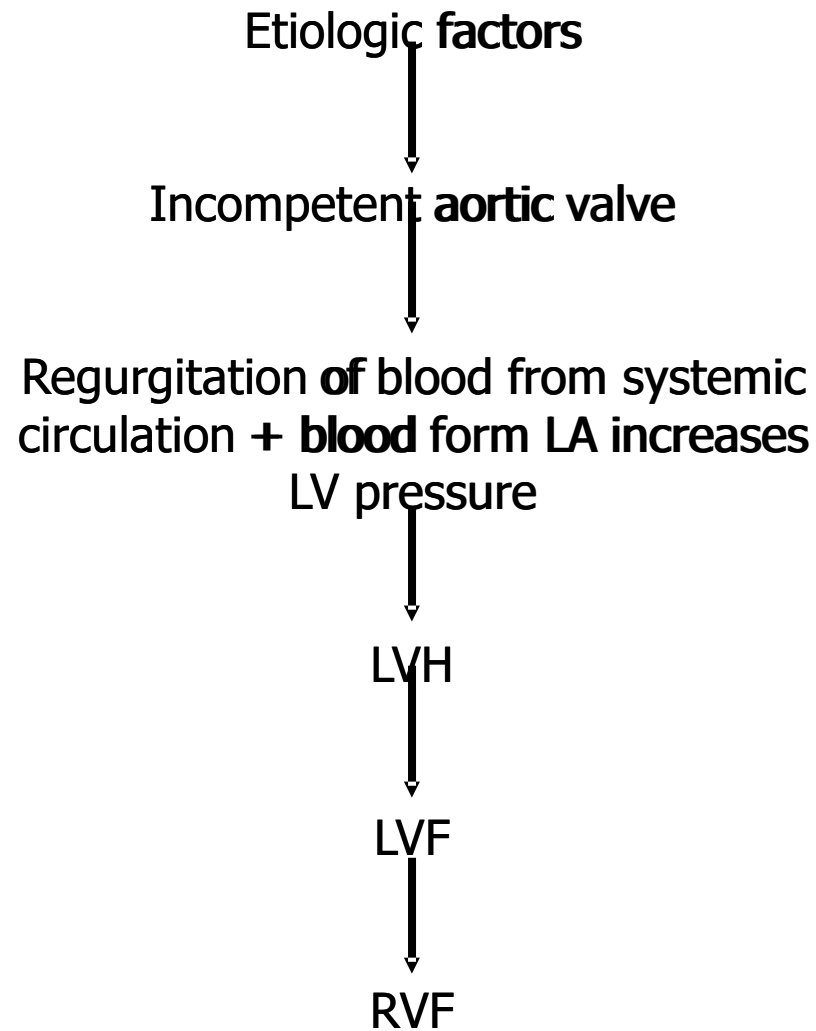


Normal valve operation



Leakage of valve

Pathophysiology



Clinical Manifestations

Usually asymptomatic

Progressive s/s of LVF

Exertional dyspnea and fatigue

breathing difficulties (e.g., orthopnea, PND)

Assessment

Diastolic murmur

Austin flint murmur

Watson's water hammer pulse

Corrigan's pulse

Widened pulse pressure

Hill's sign

Assessment

Diastolic murmur

3 Austin Flint Murmur.avi.flv

high-pitched, blowing sound at the third or 4th ICS L
sternal border

sitting up and leaning forward

Austin flint murmur

low pitched diastolic rumble similar to mitral stenosis;
indicates moderate to severe insufficiency
a mid-diastolic or presystolic murmur low-pitched
rumbling murmur which is best heard at the cardiac apex.
A murmur due to aortic regurgitation, originating at the
mitral valve when blood enters simultaneously from both
the aorta and the left atrium.

Assessment



Watson's water hammer pulse

AKA: collapsing pulse, cannonball pulse

is the medical sign which describes a pulse that is bounding and forceful, as if it were the hitting of a water hammer that was causing the pulse.

PA: radial pulse of a supine patient with arm at side is firmly palpated with slight pressure until the pulse is obscured. The arm is then raised over the patient's head, with the arm perpendicular to the supine patient.

Assessment

Corrigan's pulse

marked arterial pulsations

forceful heartbeat visible or palpable at the carotid or temporal arteries.

result of the increased force and volume of the blood ejected from the hypertrophied LV.

De Musset's sign

Rhythmic nodding or bobbing of the head in synchrony with the heart beat

Increased pulse pressure

Refers to the difference between the systolic pressure and the diastolic pressure.

Normal - 50-60.

<http://depts.washington.edu/physdx/heart/physical.html>

Assessment

Hill's sign

systolic blood pressure is higher in the legs than in the arms(> 20mmHg) .

Pistol shot femoral pulse (Traube's sign)

short, loud, snapping sounds with each pulse with auscultation over the femoral, brachial, or radial pulse.

a pulse that sounds like a pistol shot

Assessment

Duroziez's sign

to-and-fro murmur over the lightly compressed femoral arteries

a double murmur over the femoral or other large peripheral artery; due to aortic insufficiency.

Assessment

Quincke's pulse

systolic blushing and diastolic blanching of the nail bed when gentle pressure is place on the nail
alternate blanching and flushing of the nail bed due to pulsation of subpapillary arteriolar and venous plexuses;

QUINCKE'S PULSE.wmv

4 Quincke's pulse.avi.flv

Diagnostic Findings

Diagnosis may be confirmed

Echocardiogram

radionuclide imaging

ECG

Magnetic resonance imaging

cardiac catheterization

Management: aortic stenosis and regurgitation

antibiotic prophylaxis

Before the patient undergoes invasive or dental procedures

to prevent endocarditis

Treat HF and dysrhythmias

Management: aortic stenosis and regurgitation

Aortic valve replacement

Aortic Valve Replacement.mp4

treatment of choice

Aortic Valve replacement- OR.flv

One- or two-balloon percutaneous aortic valvuloplasty

For symptomatic and not surgical candidates

Note: surgery is recommended for any patient with left ventricular hypertrophy, regardless of the presence or absence of symptoms.

Tricuspid Regurgitation

Tricuspid Regurgitation

a disorder in which the heart's tricuspid valve does not close properly, causing blood to flow backward (leak) into the right upper heart chamber (atrium) when the right lower heart chamber (ventricle) contracts.

<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001222/>

Etiology

Infective endocarditis- drug abusers

RVF/LVF

Rheumatic Heart disease

RV infarction

Ebstein's anomaly



Ebstein's anomaly

rare heart defect in which parts of the tricuspid valve are abnormal.

leaflets are unusually deep in the RV ; often larger than normal.

Congenital defect

exact cause is unknown

although the use of certain drugs (such as lithium or benzodiazepines) during pregnancy may play a role.

condition is rare

Clinical Features

Holosystolic / Pansystolic murmur in tricuspid area

High-pitched

increases with inspiration

At parasternal region at 4th ICS

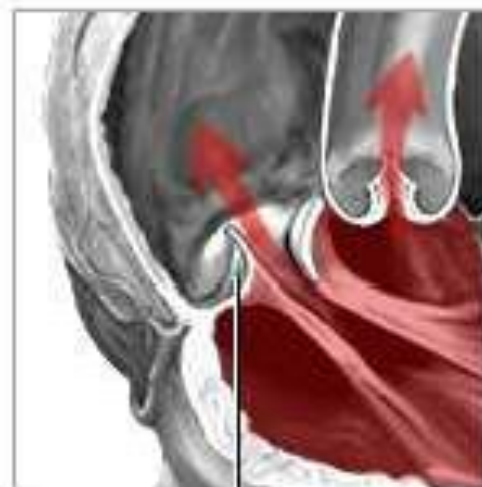
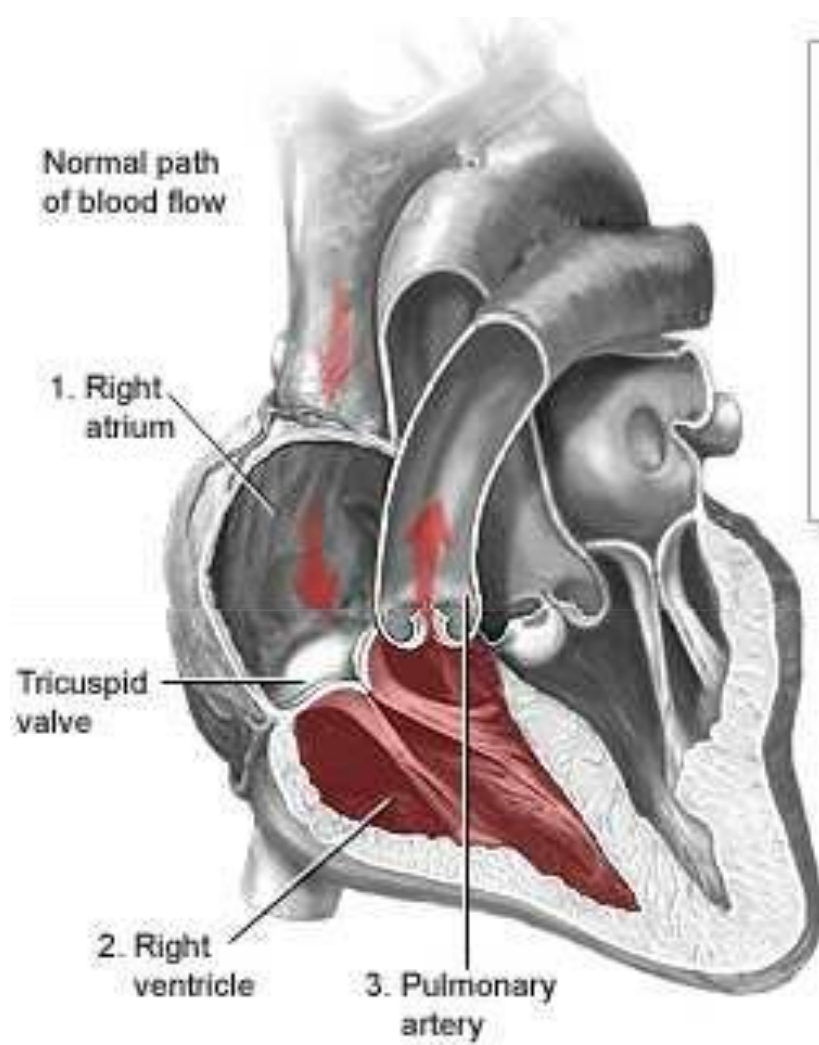
s/s RHF

Hepatic congestion, RUQ pain, jaundice

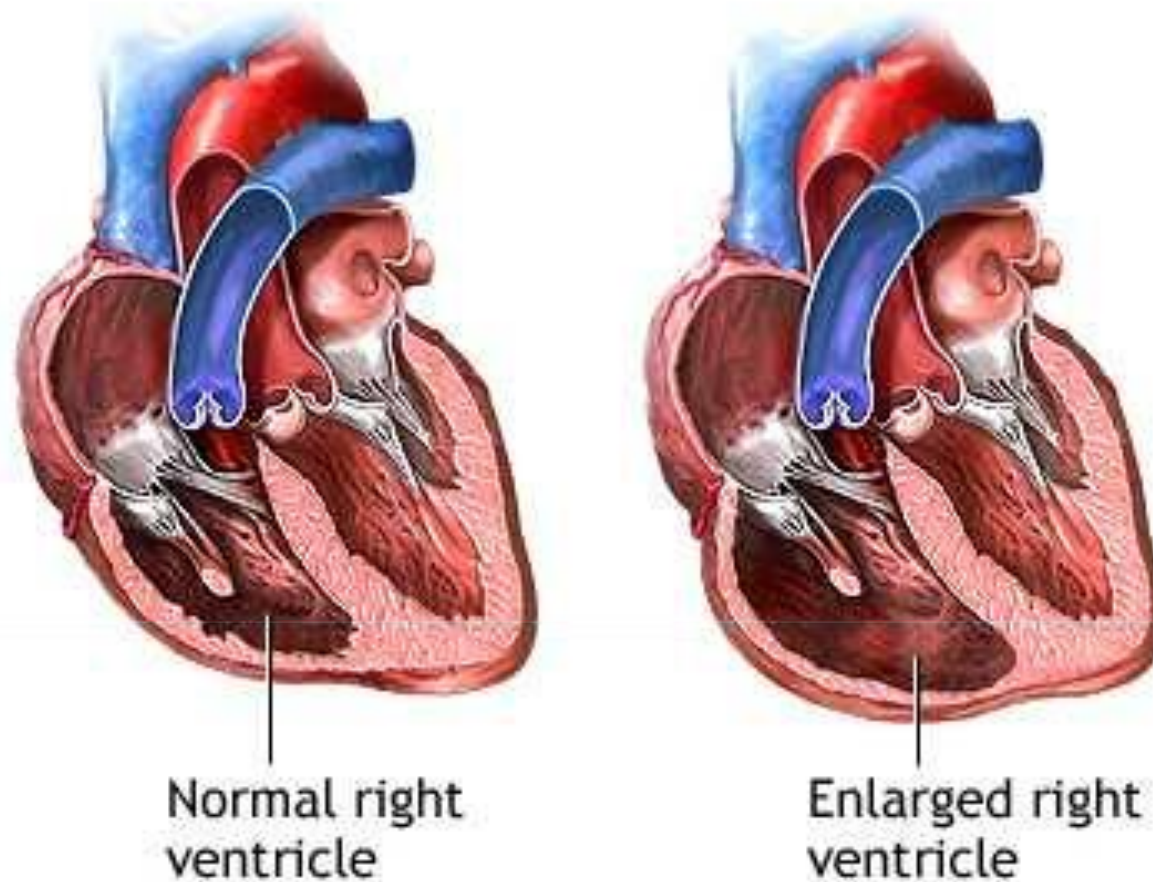
Pulsatile liver

Right ventricular lift

Jugular venous pulsation



Malfunctioning tricuspid valve allows backflow of blood into the right atrium.



 ADAM.

Tricuspid regurgitation is a disorder involving backflow of blood from RV to RA during contraction of RV. The most common cause of tricuspid regurgitation is not damage to the valve itself but enlargement of the RV, which may be a complication of any disorder that causes RVHF.

Diagnostics

ECG- RV and RA enlargement

CXR- RV enlargement with obliteration of the retrosternal space on lateral view

Tricuspid stenosis

Tricuspid stenosis

Narrowing of tricuspid valve orifice due to commissural fusion and fibrosis

Causes

Usually follows RF

Commonly assoc with diseases of mitral valve

s/s

Rumbling or blowing mid-diastolic murmur
along L sternal border

Management: tricuspid stenosis or regurgitation

Treat left sided HF

Valvuloplasty

Valve replacement

NURSING MANAGEMENT

Educate, educate, educate

Educate about

Diagnosis

progressive nature of valvular heart disease

treatment plan

report any new symptoms or changes in
symptoms

Educate, educate, educate

Emphasize need for **prophylactic antibiotic therapy** before any invasive procedure that may introduce infectious agents to the patient's bloodstream.

(e.g., dental work, genitourinary or gastrointestinal procedure)

Educate, educate, educate

Teach that infectious agent (usually a bacterium) is able to adhere to the diseased heart valve more readily than to a normal valve. Once attached to the valve, the infectious agent multiplies, resulting in **endocarditis** and further damage to the valve.

Educate, educate, educate

Collaborate with patient

develop a **meds schedule**

teach about **name, dosage, actions, side effects,**
and any drug-drug or drug-food interactions of
the prescribed meds for HF , dysrhythmias,
angina pectoris, or other symptoms

Educate, educate, educate

Teach to **weigh daily**
report weight gain of 2 pounds in 1 day or 5
pounds in 1 week
assist patient with **planning activity and rest**
periods to achieve a lifestyle acceptable to
the patient.

Assess

VS : HR, BP RR measured and compared with previous data for any changes.

Auscultate heart and lung sounds

Palpate peripheral pulses

Assess

Assess s/s HF

fatigue, dyspnea with exertion, increase in coughing, hemoptysis, multiple respiratory infections, orthopnea, or PND

Assess

Assess dysrhythmias

by palpating the patient's pulse for strength and rhythm (ie, regular or irregular) and asks if the patient has experienced palpitations or felt forceful heartbeats

Assess for dizziness, syncope, increased weakness, or angina pectoris



Peiop care - surgical valve replacement or
valvuloplasty

Valve Repair and Replacement Procedures

Valve Repair and Replacement Procedures

VALVULOPLASTY

VALVULOPLASTY

VALVULOPLASTY

Repair of a cardiac valve

Types

Commissurotomy

Annuloplasty

Chordoplasty

Type of valvuloplasty

depends on the cause and type of valve dysfunction.

Commissurotomy

Repair to commissures between leaflets

Annuloplasty

Repair to annulus of the valve by

Leaflet repair

Chordoplasty

Repair to the chordae

Valvuloplasty procedures

Most require

- general anesthesia

- cardiopulmonary bypass

Some can be performed in the cath lab

- Percutaneous partial cardiopulmonary bypass

Nursing responsibilities

CCU - first 24 to 72 hrs post op

PACU/ CCU care

focus hemodynamic stabilization & recovery from anesthesia

VS q 5 to 15 min and as needed until recovers from anesthesia or sedation

- then q 2 to 4 hrs and as needed

IV meds

- blood pressure; dysrhythmias

Patient assessments

- q 1 to 4 hrs and PRN
- Esp neuro, respi, cardio

Nursing responsibilities

Patient transferred to a telemetry or surgical unit
after recovery from anesthesia & sedation
hemodynamically stable without IV meds
assessments are stable

~~Surgical area care~~

wound care

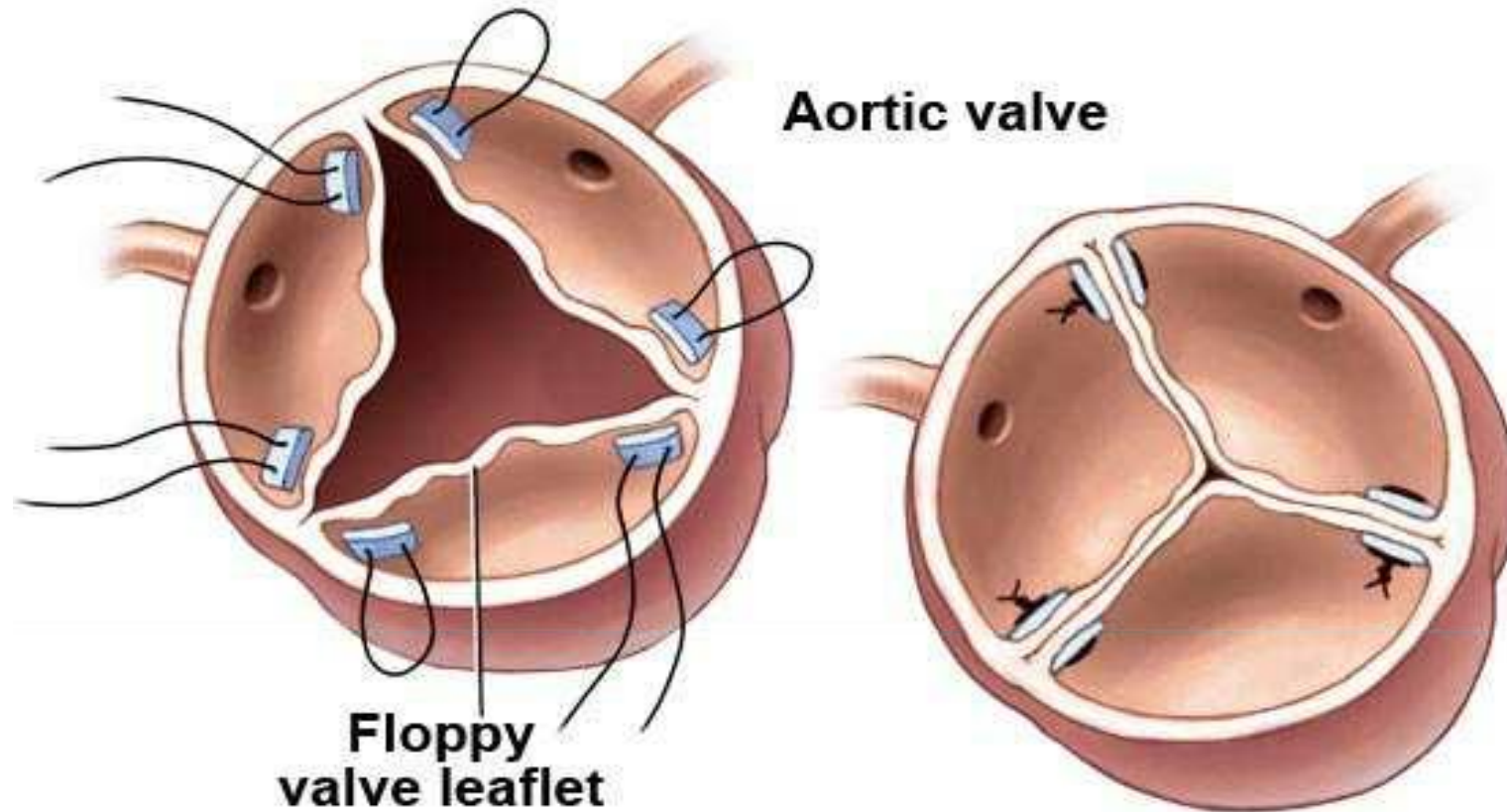
patient teaching regarding diet, activity, medications, and self-care.

Patients are **discharged** from the hospital in 1 to 7 days.

In general, valves that have undergone valvuloplasty function longer than replacement valves, and the patients do not require continuous anticoagulation.

Commissurotomy

most common valvuloplasty
the procedure performed to separate the
fused leaflets.



Commissurotomy is a special form of valvuloplasty. Commissurotomy is used when the leaflets of the valve become stiff and actually fuse together at the base, which is the ring portion (or annulus) of the valve. Sometimes a scalpel is used to cut the fused leaflets (commissures) near the ring, which may help them open and close better. In other cases, a balloon catheter, similar to a catheter used during angioplasty, is inserted into the valve. The balloon is inflated, splitting the commissures and freeing the leaflets to open and shut fully.

Normally

each valve has leaflets;
the site where the leaflets meet is called the
commissure.

The leaflets may adhere to one another and
close the commissure (i.e., stenosis).

leaflets fuse in such a way that, in addition to
stenosis, the leaflets are also prevented from
closing completely, resulting in a backward flow
of blood (i.e., regurgitation).

Types of Commissurotomy

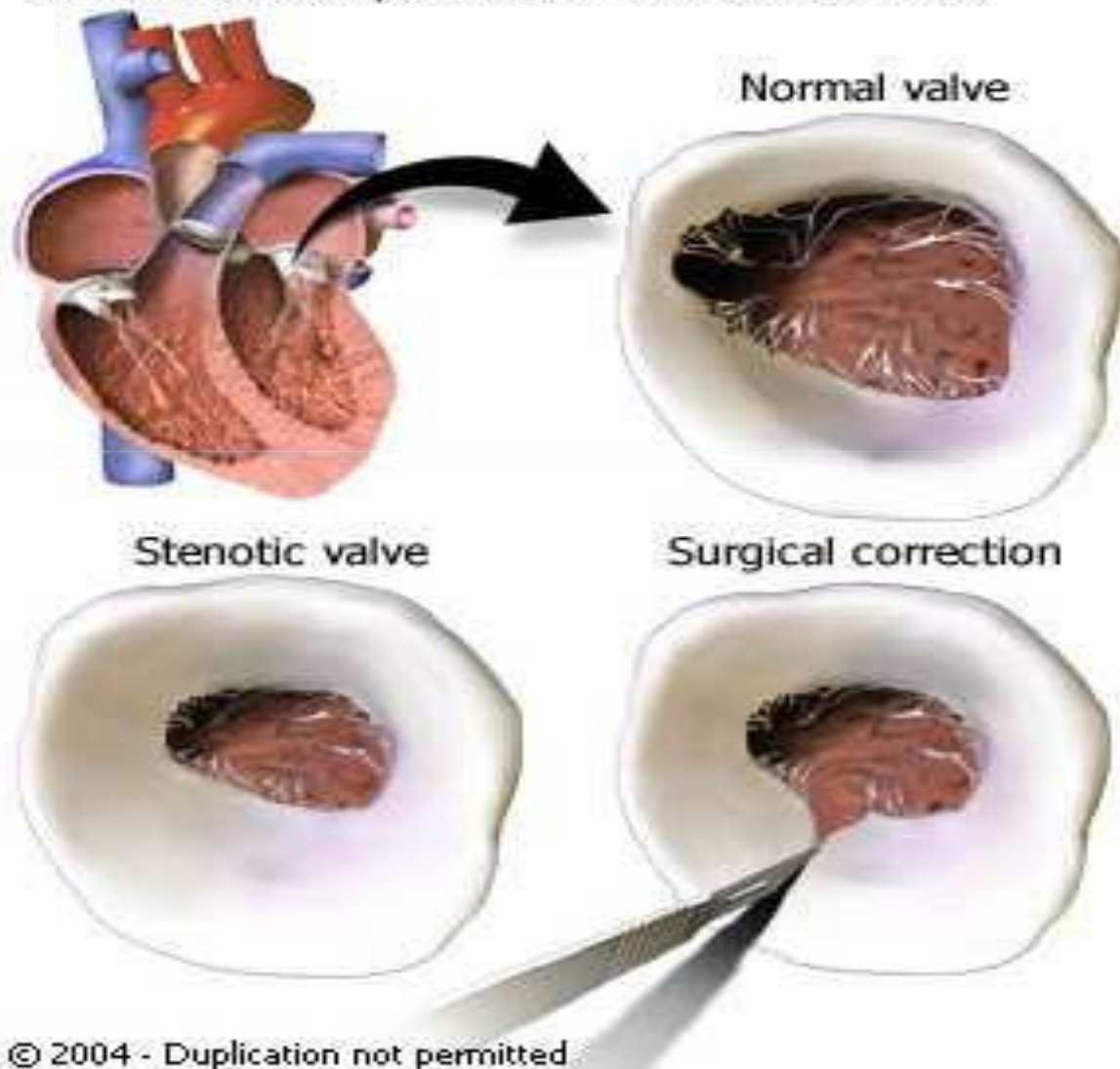
CLOSED COMMISSUROTOMY

Balloon Valvuloplasty

OPEN COMMISSUROTOMY

Commissurotomy

A surgical procedure performed to open a stenotic (narrowed) valve. A stenotic valve restricts the flow of blood. A scalpel incision widens the valve.



CLOSED COMMISSUROTOMY

do not require cardiopulmonary bypass

The valve is not directly visualized.

general anesthetic

midsternal incision

a small hole is cut into the heart

surgeon's finger or a dilator is used to break open the commissure.

for mitral, aortic, tricuspid, and pulmonary valve disease.

Balloon Valvuloplasty

Another type of closed commissurotomy

Indications

- For mitral and aortic valve stenosis

- younger patients

- for aortic valve stenosis in elderly patients

- patients with complex medical conditions that place them at high risk for the complications of more extensive surgical procedures.

- also has been used for tricuspid and pulmonic valve stenosis

Balloon Valvuloplasty

in cath lab

local anesthetic

remain in hospital 24 to 48 hours postop

Balloon Valvuloplasty

C/I

Left atrial or ventricular thrombus

severe aortic root dilation

Significant mitral valve regurgitation

thoracolumbar scoliosis,

Rotation of the great vessels

and other cardiac conditions that require open heart surgery

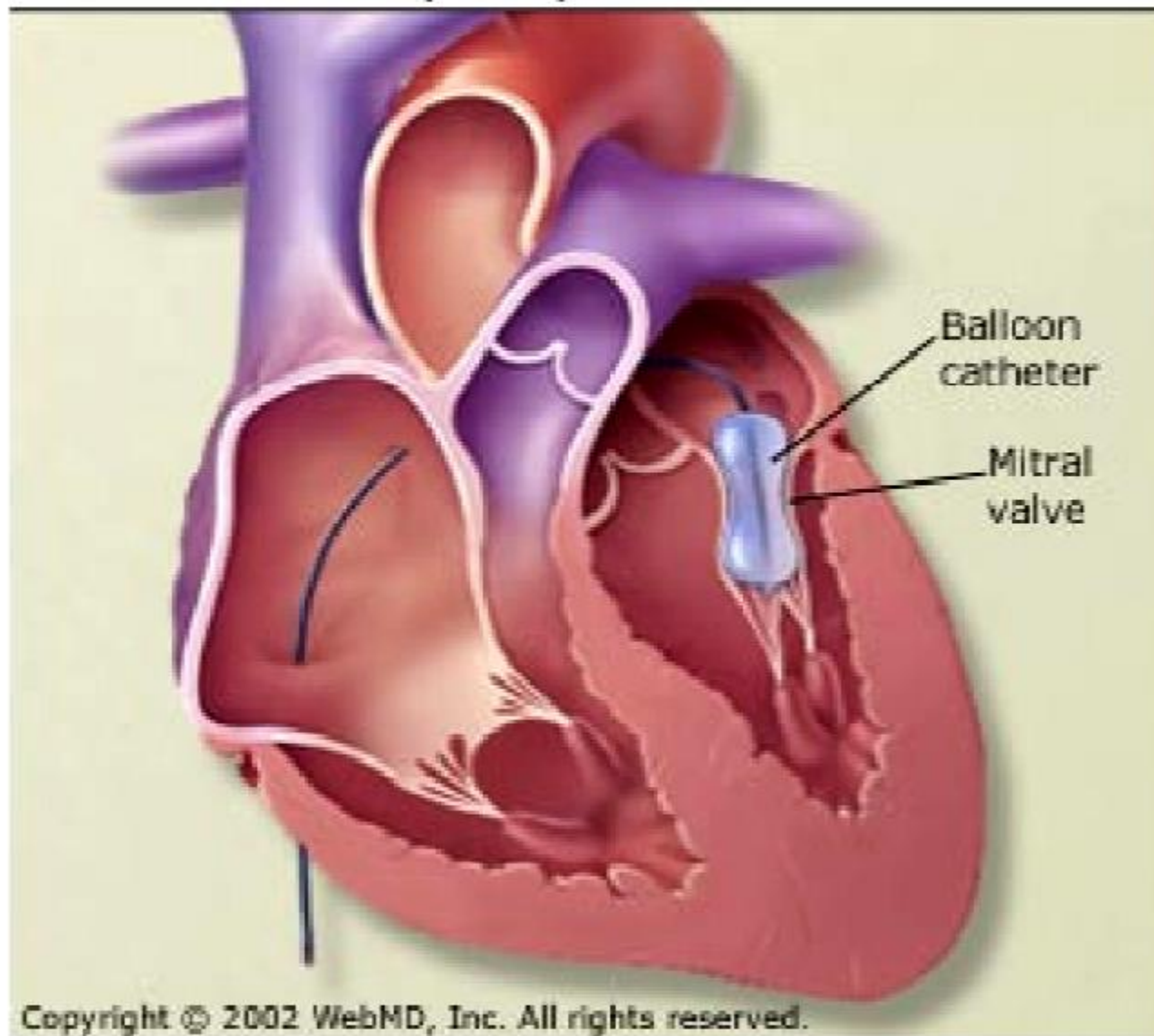
Balloon Valvuloplasty

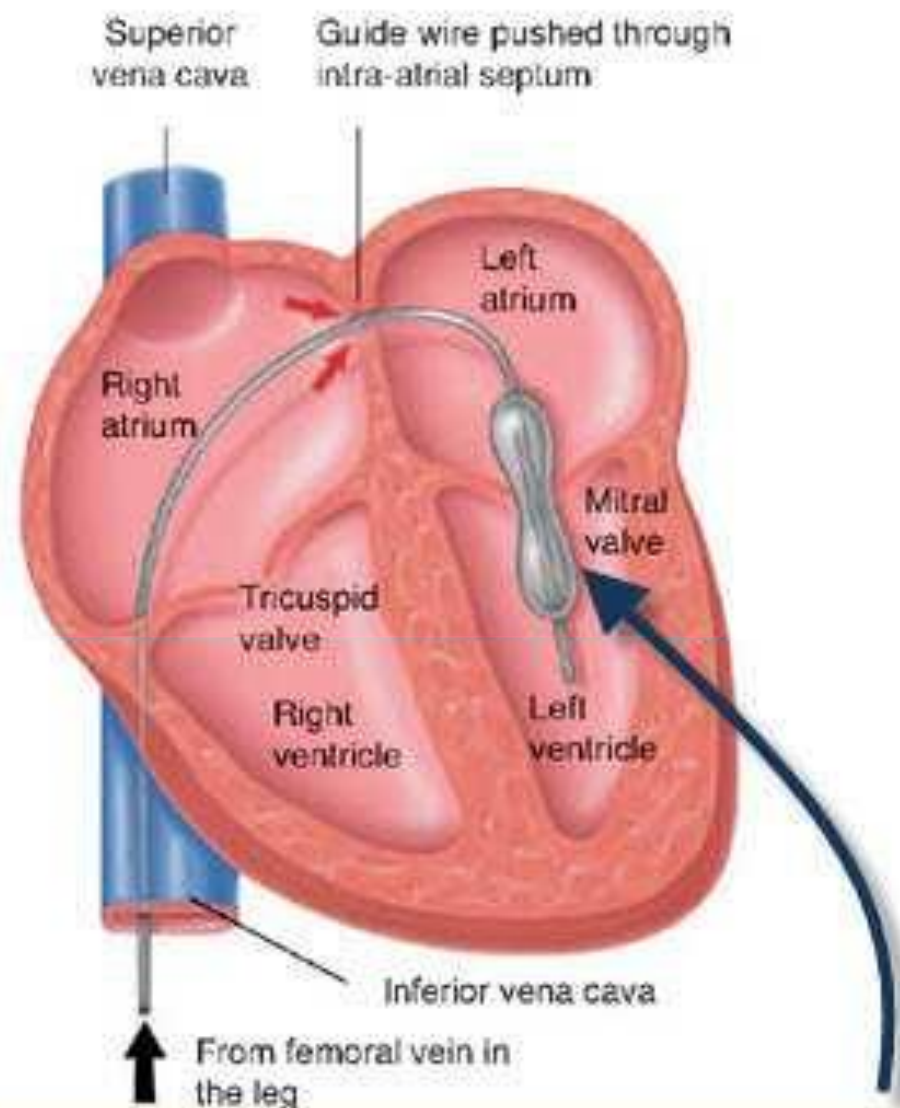
Types

Mitral balloon valvuloplasty

Aortic balloon valvuloplasty

Balloon Valvuloplasty





Balloon valvuloplasty: Balloon is inflated to widen the narrowed mitral valve

Mitral balloon valvuloplasty

A balloon-tipped catheter is percutaneously inserted, threaded to affected valve, and positioned across narrowed orifice
Balloon is inflated and deflated, causing a crack of the calcified commissures and enlargement of the valve orifice

Mitral balloon valvuloplasty

Complications

- some degree of mitral regurgitation
- bleeding from catheter insertion sites
- emboli resulting in complications such as strokes
- left-to-right atrial shunts through an atrial septal defect caused by the procedure.

Aortic balloon valvuloplasty

introduce catheter thru aorta, across AV, and into LV .

The one-balloon or the two-balloon technique can be used for treating aortic stenosis.

not as effective as procedure for mitral valve,
rate of restenosis - nearly 50% in first 12 to 15
mos post op

Aortic balloon valvuloplasty

complications

- aortic regurgitation

- emboli

- ventricular perforation

- rupture of the aortic valve annulus

- Ventricular dysrhythmias

- mitral valve damage

- bleeding from the catheter insertion sites

Types of Commissurotomy

CLOSED COMMISSUROTOMY

Balloon Valvuloplasty

OPEN COMMISSUROTOMY

OPEN COMMISSUROTOMY

performed with direct visualization of valve
general anesthesia

Median sternotomy or left thoracic incision
Cardiopulmonary bypass

incision is made into the heart

A finger, scalpel, balloon, or dilator may be used
to open the commissures

direct visualization of valve

Advantages: thrombus ID and removed, calcifications
can be seen, and if valve has chordae or papillary
muscles, they may be surgically repaired

VALVULOPLASTY

Repair of a cardiac valve

Types

Commissurotomy

Annuloplasty

Chordoplasty

Annuloplasty

repair of the valve annulus (i.e., junction of the valve leaflets and the muscular heart wall)
Or retailoring of the valve ring
narrows the diameter of the valve's orifice
and is useful for the treatment of valvular regurgitation.

Annuloplasty

General anesthesia & cardiopulmonary bypass

2 techniques

(1) use annuloplasty ring

The leaflets of the valve are sutured to a ring, creating an annulus of the desired size. When the ring is in place, the tension created by the moving blood and contracting heart is borne by ring rather than by valve or a suture line,

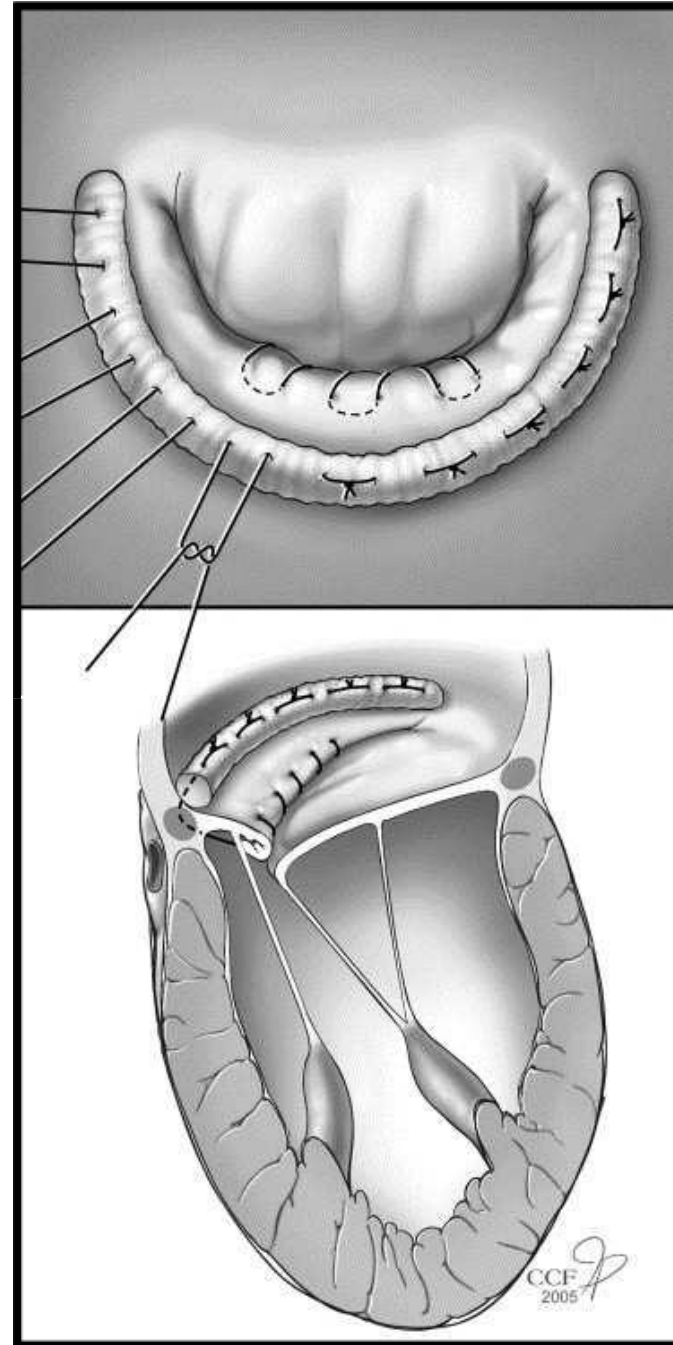
(2) tacking the valve leaflets to atrium with sutures or

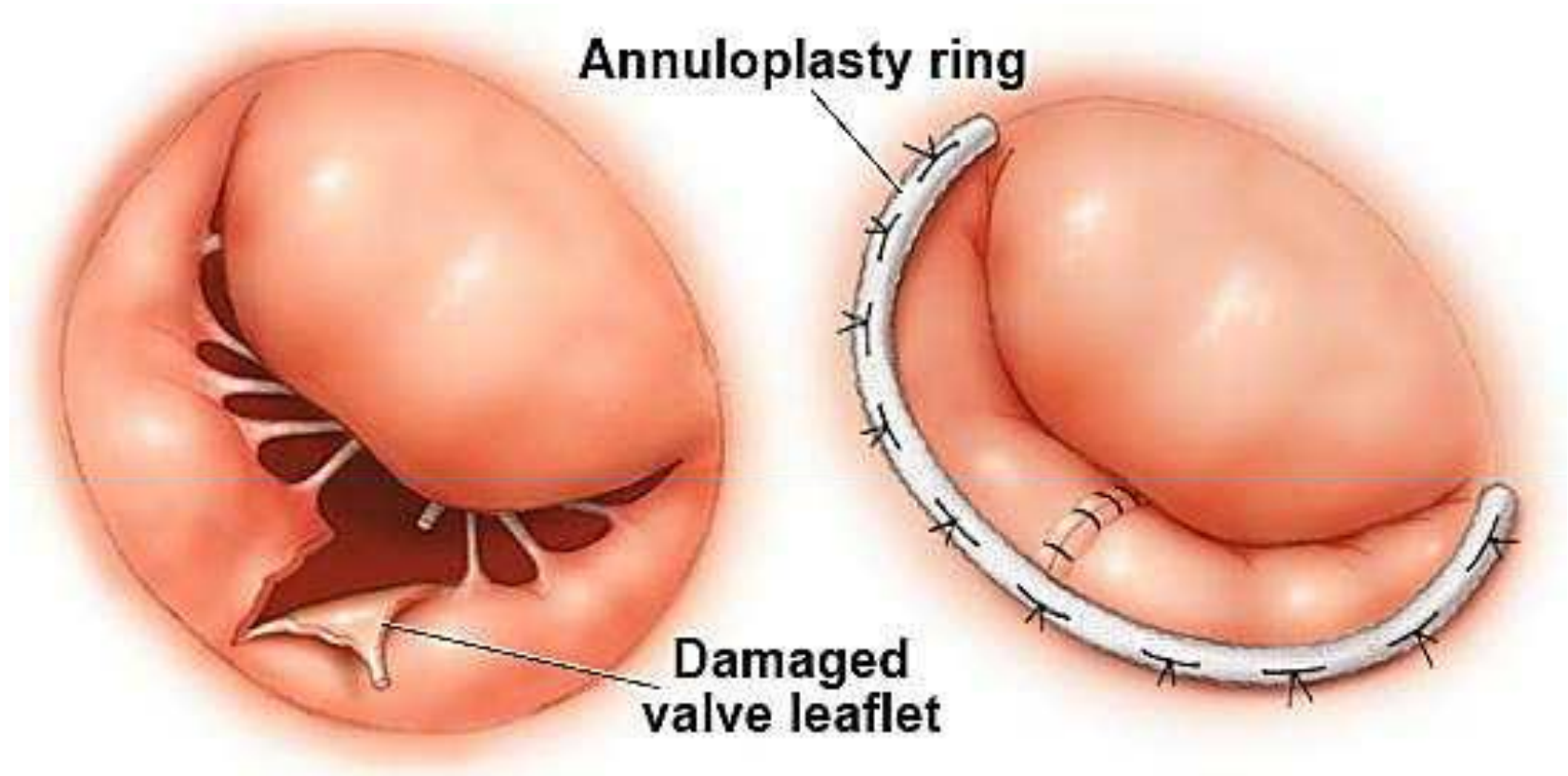
taking tucks to tighten the annulus.

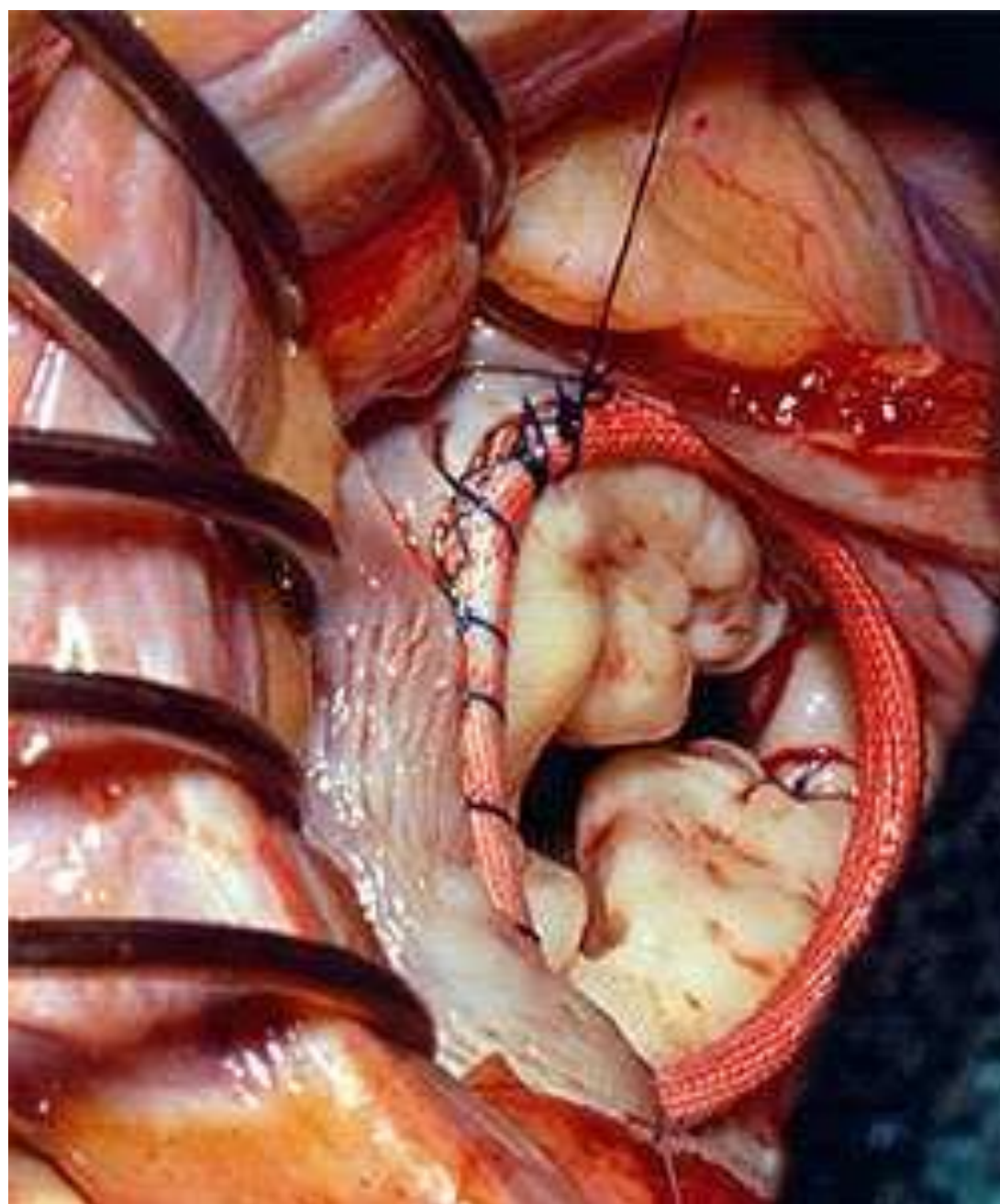
may degenerate more quickly than with the annuloplasty ring technique

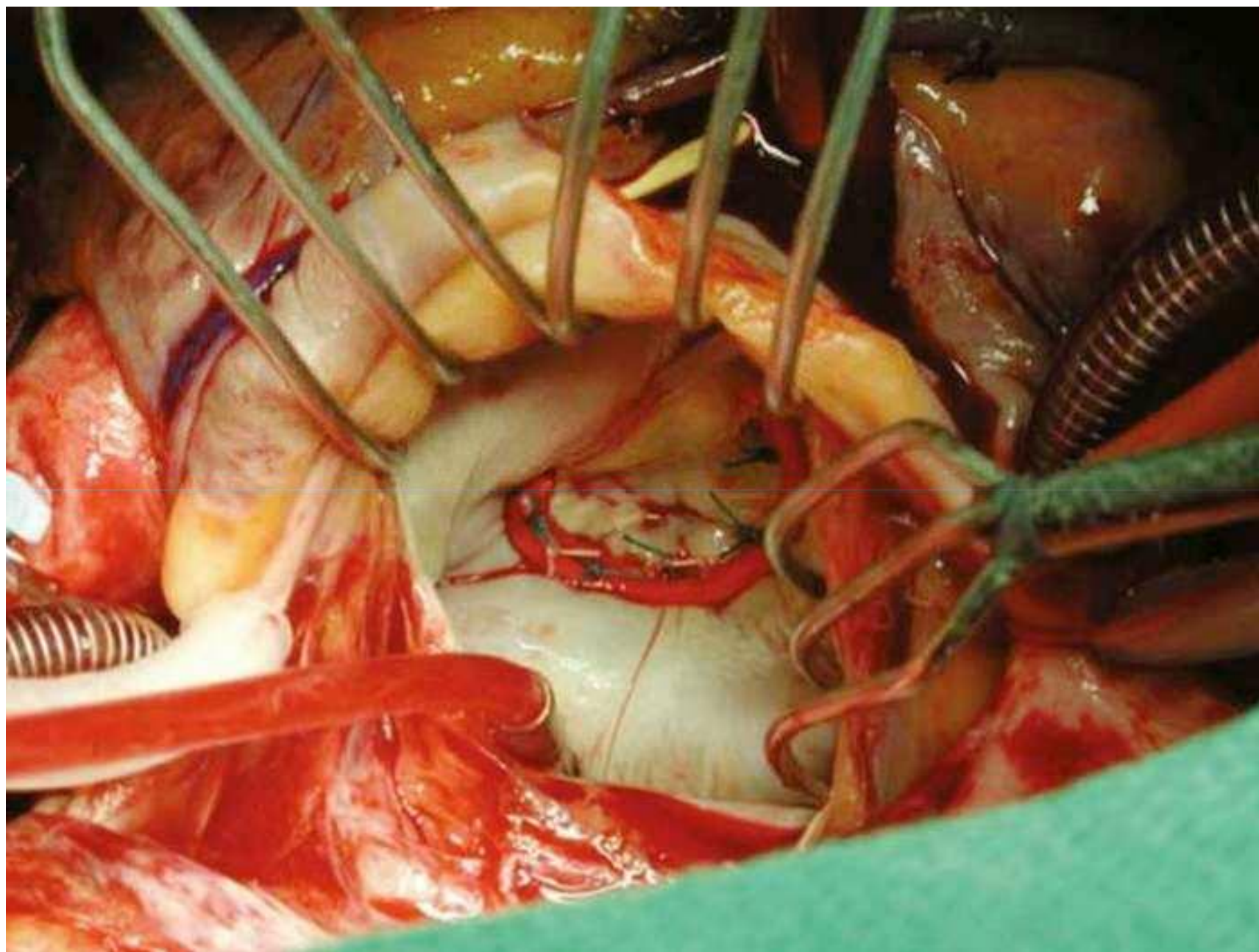
- Because valve's leaflets and suture lines are subjected to the direct forces of the blood and heart muscle movement,

Annuloplasty ring









Leaflet Repair

Damage to cardiac valve leaflets may result from stretching, shortening, or tearing.

Types:

- removal of the extra tissue

- tucked

- leaflet plication

- leaflet resection

Leaflet Repair

Leaflet repair for elongated, ballooning, or other excess tissue leaflets is removal of the extra tissue.

The elongated tissue may be folded over onto itself (i.e., tucked) and sutured (i.e., leaflet plication).

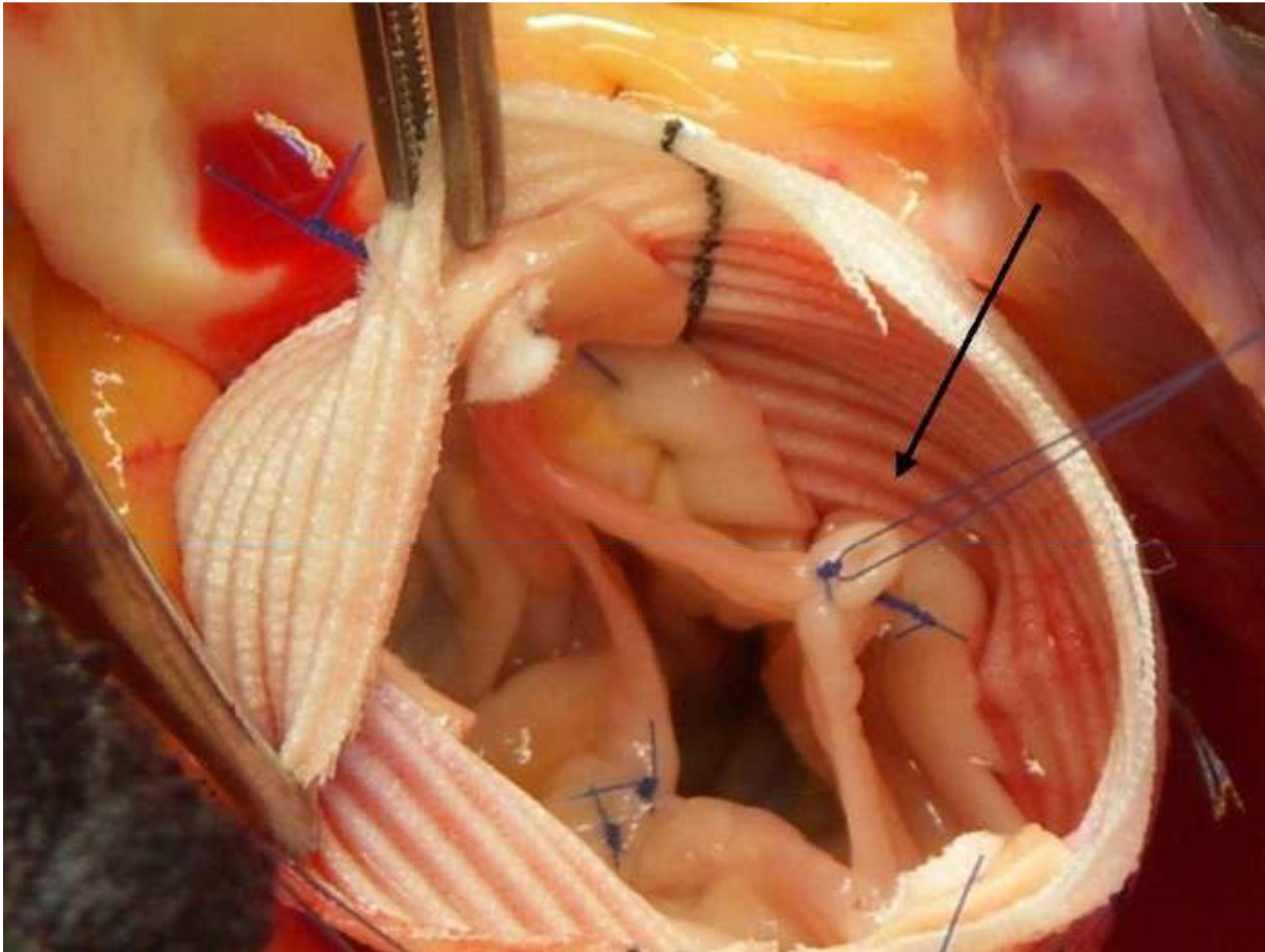


Image of the aortic leaflets after correction of the prolapse using free edge plication with prolene 6/0 sutures.

Leaflet Repair

leaflet resection

A wedge of tissue cut from middle of leaflet and gap
sutured closed

Short leaflets are most often repaired by
chordoplasty.

After the short chordae are released, the leaflets
often unfurl and can resume their normal
function of closing the valve during systole. A
piece of pericardium may also be sutured to
extend the leaflet.

A pericardial patch may be used to repair holes
in the leaflets.

VALVULOPLASTY

Repair of a cardiac valve

Types

Commissurotomy

Annuloplasty

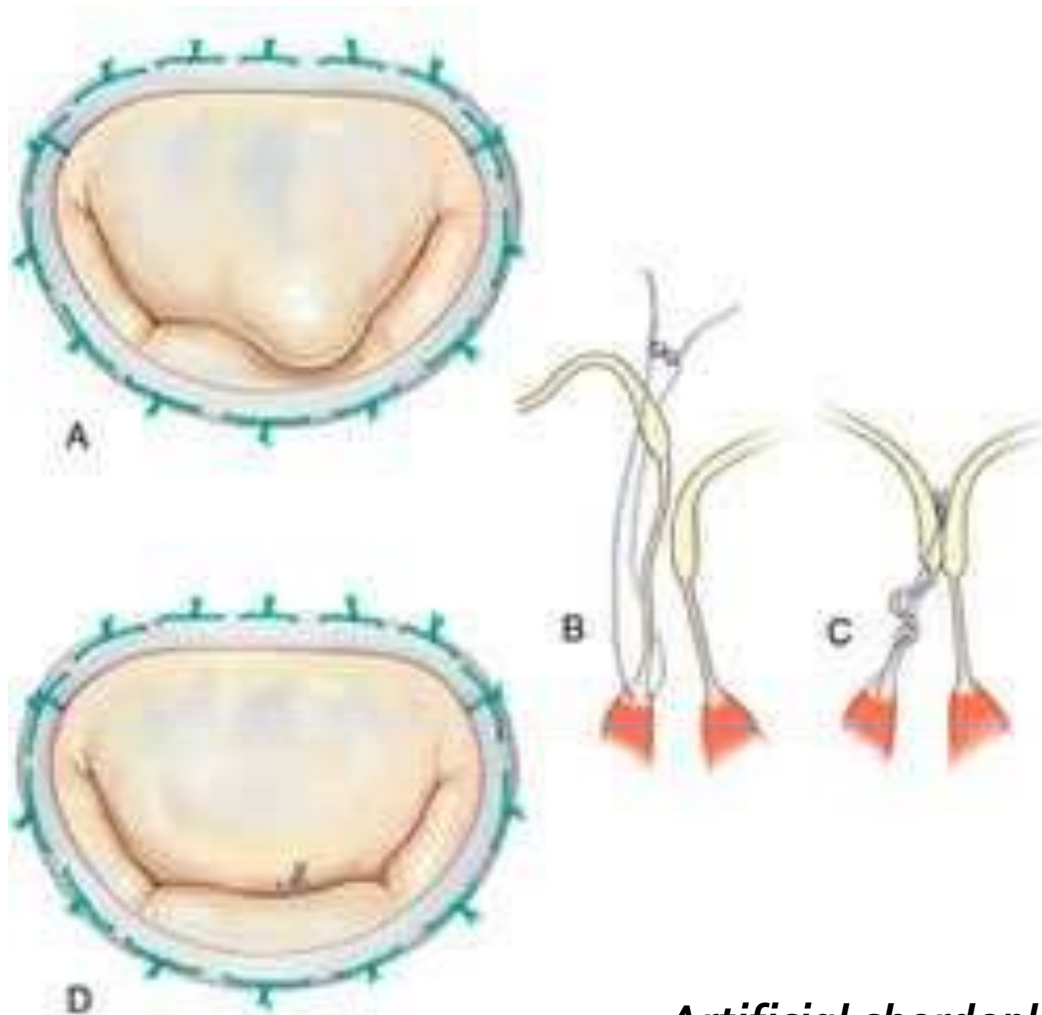
Chordoplasty

Chordoplasty

is the repair of the chordae tendineae.
mitral valve is involved with chordoplasty
(because it has the chordae tendineae);
seldom is chordoplasty required for the
tricuspid valve.

Chordoplasty

Regurgitation may be caused by stretched, torn, or shortened chordae tendineae. Stretched chordae tendineae can be shortened, torn ones can be reattached to the leaflet, and shortened ones can be elongated. Regurgitation may also be caused by stretched papillary muscles, which can be shortened.



Artificial chordoplasty. *A*, residual prolapse of A2 is evident on saline testing. *B*, a Gore-Tex suture is passed through the fibrous tip of the papillary muscle and the margin of the prolapsing segment. *C*, optimal artificial chordae height is determined by intermittently testing valve competency by injecting saline into the ventricle. *D*, a final saline test confirms correction of prolapse.*

VALVE REPLACEMENT

VALVE REPLACEMENT

Prosthetic valve replacement

annulus or leaflets of the valve are immobilized by calcifications, valve replacement is performed.

General anesthesia and cardiopulmonary bypass

median sternotomy or right thoracotomy

VALVE REPLACEMENT

valve is visualized

leaflets and other valve structures, such as the chordae and papillary muscles, are removed

Some surgeons leave the posterior mitral valve leaflet, its and function of the left ventricle after mitral valve replacement

Sutures are placed around the annulus and then into the valve prosthesis.

replacement valve is slid down the suture into position and tied into place

incision is closed, and surgeon evaluates the function of the heart and the quality of the prosthetic repair.

patient is weaned from cardiopulmonary bypass, and surgery is completed.



Complications

unique to valve replacement are related to the sudden changes in intracardiac blood pressures.

All prosthetic valve replacements create a degree of stenosis when they are implanted in the heart. Usually, the stenosis is mild and does not effect heart function. If valve replacement was for a stenotic valve, blood flow through the heart is often improved.

The signs and symptoms of the backward heart failure resolve in a few hours or days. If valve replacement was for a regurgitant valve, it may take months for the chamber into which blood had been regurgitating to achieve its optimal postoperative function. The signs and symptoms of heart failure resolve gradually as the heart function improves. The patient is at risk for many postoperative complications, such as bleeding, thromboembolism, infection, congestive heart failure, hypertension, dysrhythmias, hemolysis, and mechanical obstruction of the valve.

Types of Valve Prostheses

Two types of valve prostheses may be used:

- mechanical valves

- Tissue (i.e., biologic) valves

MECHANICAL VALVES

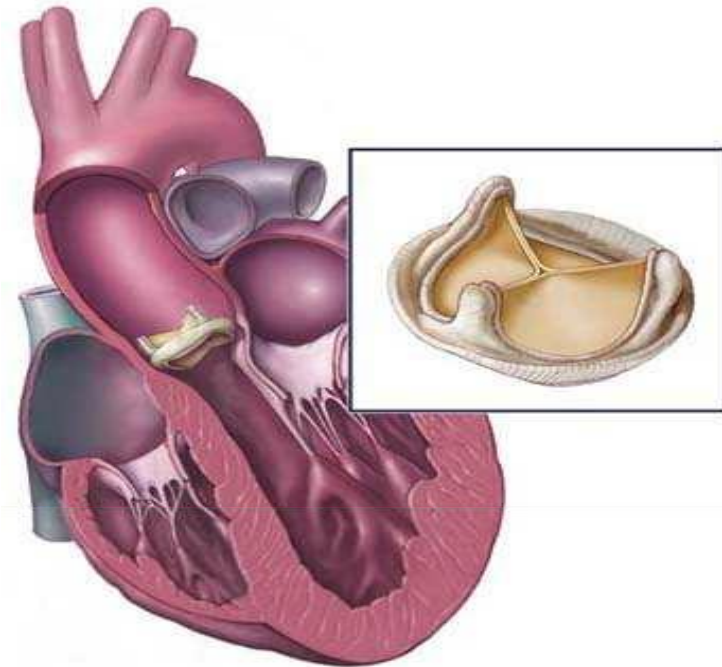
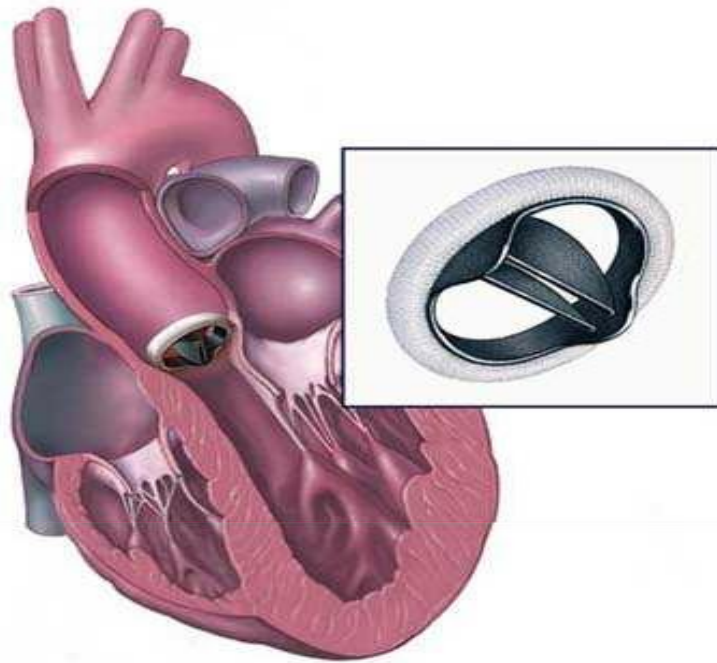
Designs: ball-and-cage or disk
thought to be more durable than tissue
prosthetic valves

Indications:

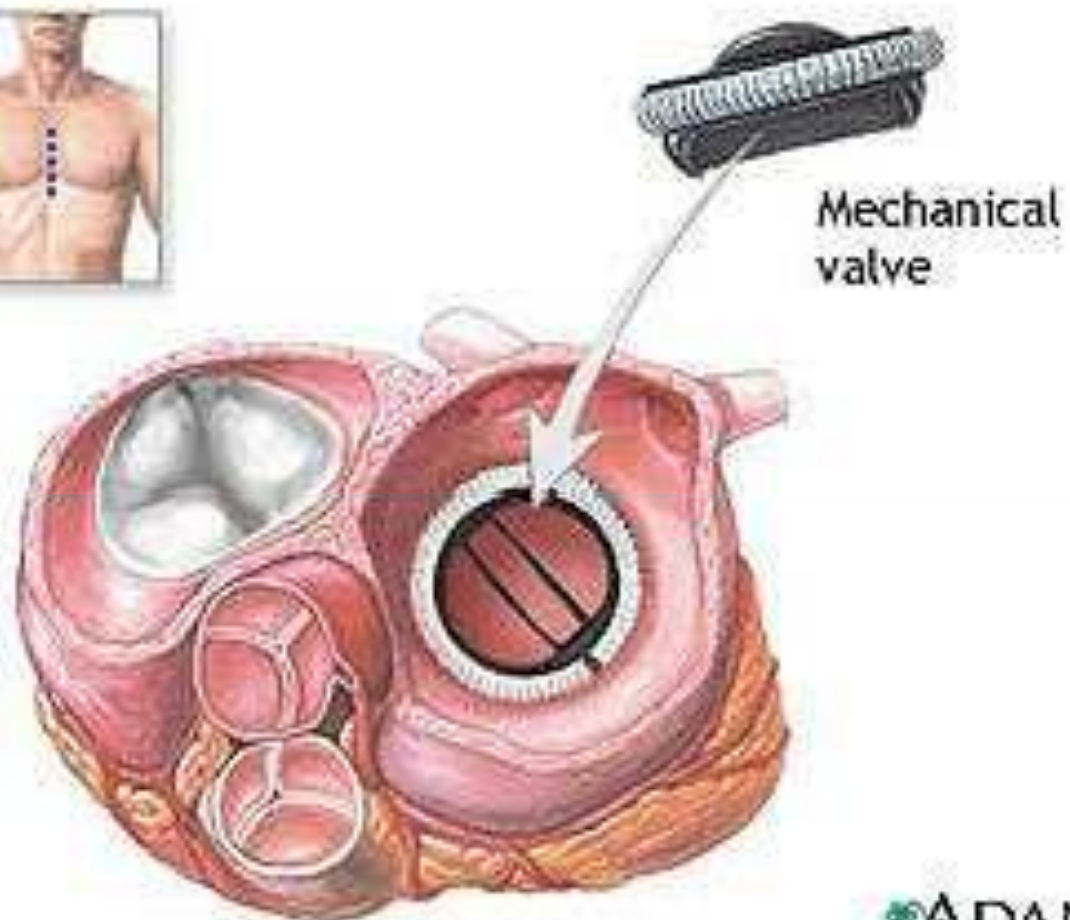
- younger patients

- if the patient has renal failure, hypercalcemia,
endocarditis, or sepsis and requires valve
replacement.

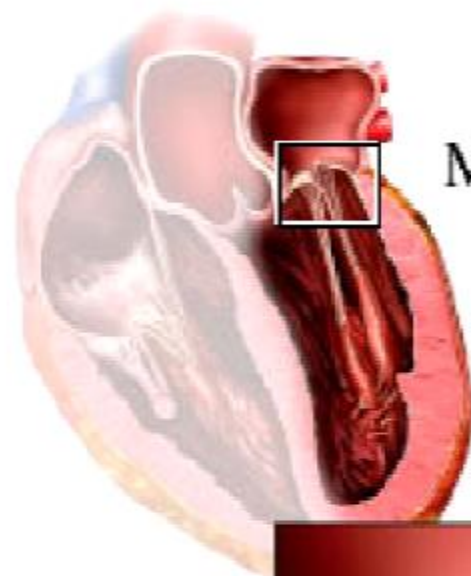
- do not deteriorate or become infected as easily as the
tissue valves used for patients with these conditions.



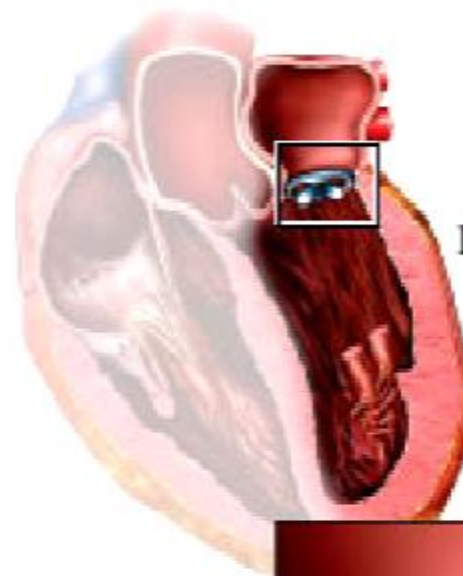
MECHANICAL VALVES



Mechanical
valve



Mitral valve
prolapse



Artificial
replacement
valve



MECHANICAL VALVES

long-term anticoagulation with **warfarin** is required

Thromboemboli are significant complications associated with mechanical valves

TISSUE OR BIOLOGIC VALVES

three types: xenografts, homografts, and autografts.

less likely to generate thromboemboli, and long-term anticoagulation is not required.

are not as durable as mechanical valves and require replacement more frequently.

Xenograft valves

are tissue valves (eg, bioprotheses, heterografts);

most are from pigs (porcine), but valves from cows (bovine) may also be used.

Durability - 7 to 10 yrs

don't require anticoagulation therapy

do not generate thrombi

Xenograft valves

Indications

- for women of childbearing age

- because the potential complications of long-term anticoagulation associated with menses, placental transfer to a fetus, and delivery of a child do not exist
- patients older than 70 years of age

- patients with a history of peptic ulcer disease
- and others who cannot tolerate long-term anticoagulation.

- for all tricuspid valve replacements

Homograft valves

or allografts (i.e., human valves)

obtained from cadaver tissue donations.

The aortic valve and a portion of the aorta or the pulmonic valve and a portion of the pulmonary artery are harvested and stored cryogenically.

limited availability
not always available and are very expensive.

last for about 10 to 15 years

don't require anticoagulation

not thrombogenic and are resistant to subacute bacterial endocarditis.

used for aortic and pulmonic valve replacement.

excellent hemodynamic flow pattern

Autograft valves

autologous valves are obtained by excising the patient's own pulmonic valve and a portion of the pulmonary artery for use as the aortic valve.

Anticoagulation is unnecessary

because the valve is the patient's own tissue and is not thrombogenic.

Thank You For Your Attention!