Heart Failure

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Reasons for Heart Failure

Congenital

- Pulmonary over circulation
- Post-operative
  - Expected
  - Complication

Acquired

- Cardiomyopathy
- Infection
  - Myocarditis
  - Endocarditis
  - Rheumatic heart disease
- Arrythmia
- Anemia

Principles of Blood Flow

Qp:Qs

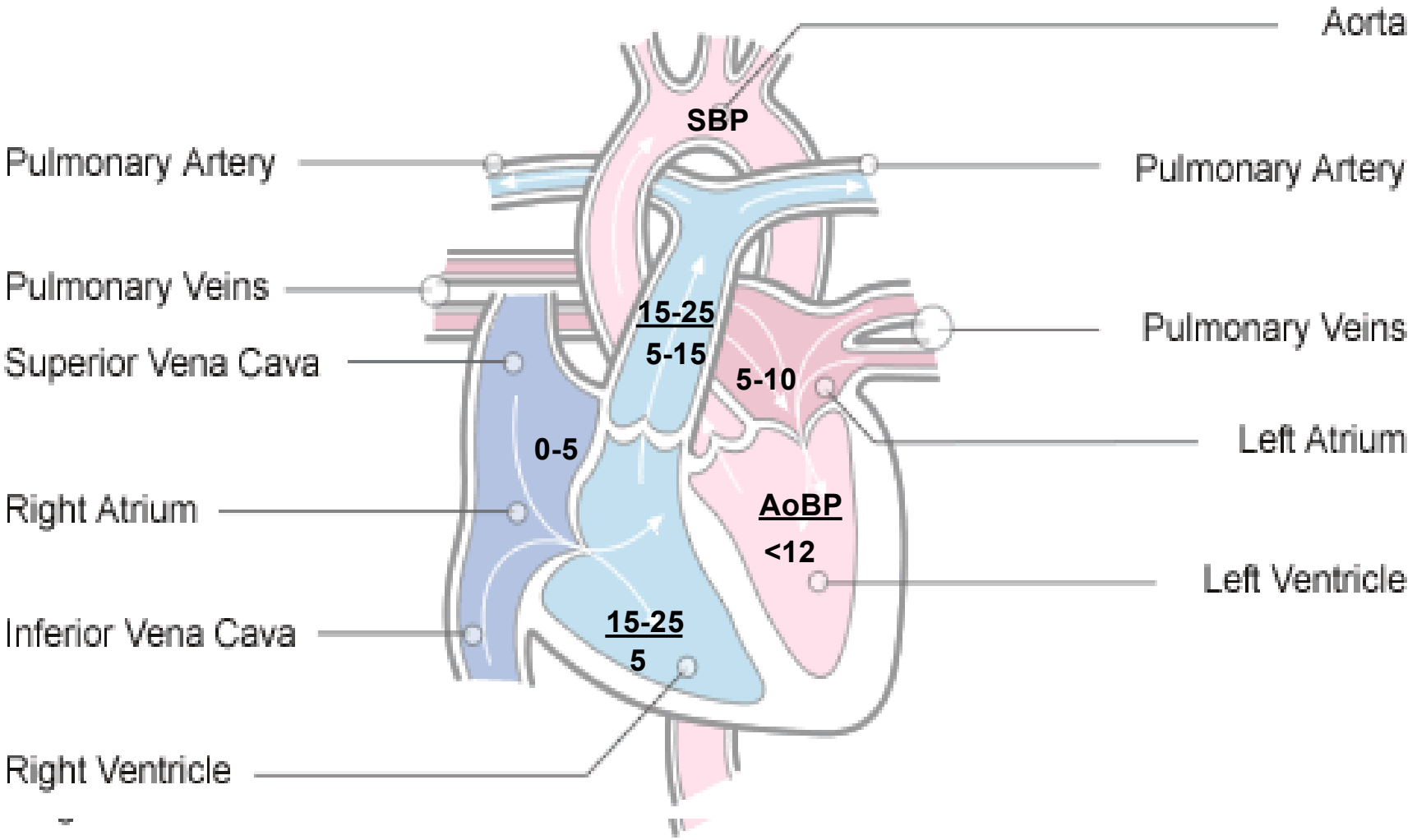
Qp= Pulmonary artery- pulmonary vein

Qs= Systemic artery-systemic vein

Normal heart 1:1 but how do we get that??

A hole of significant size will equalize pressure between chambers

Normal Intracardiac Pressures

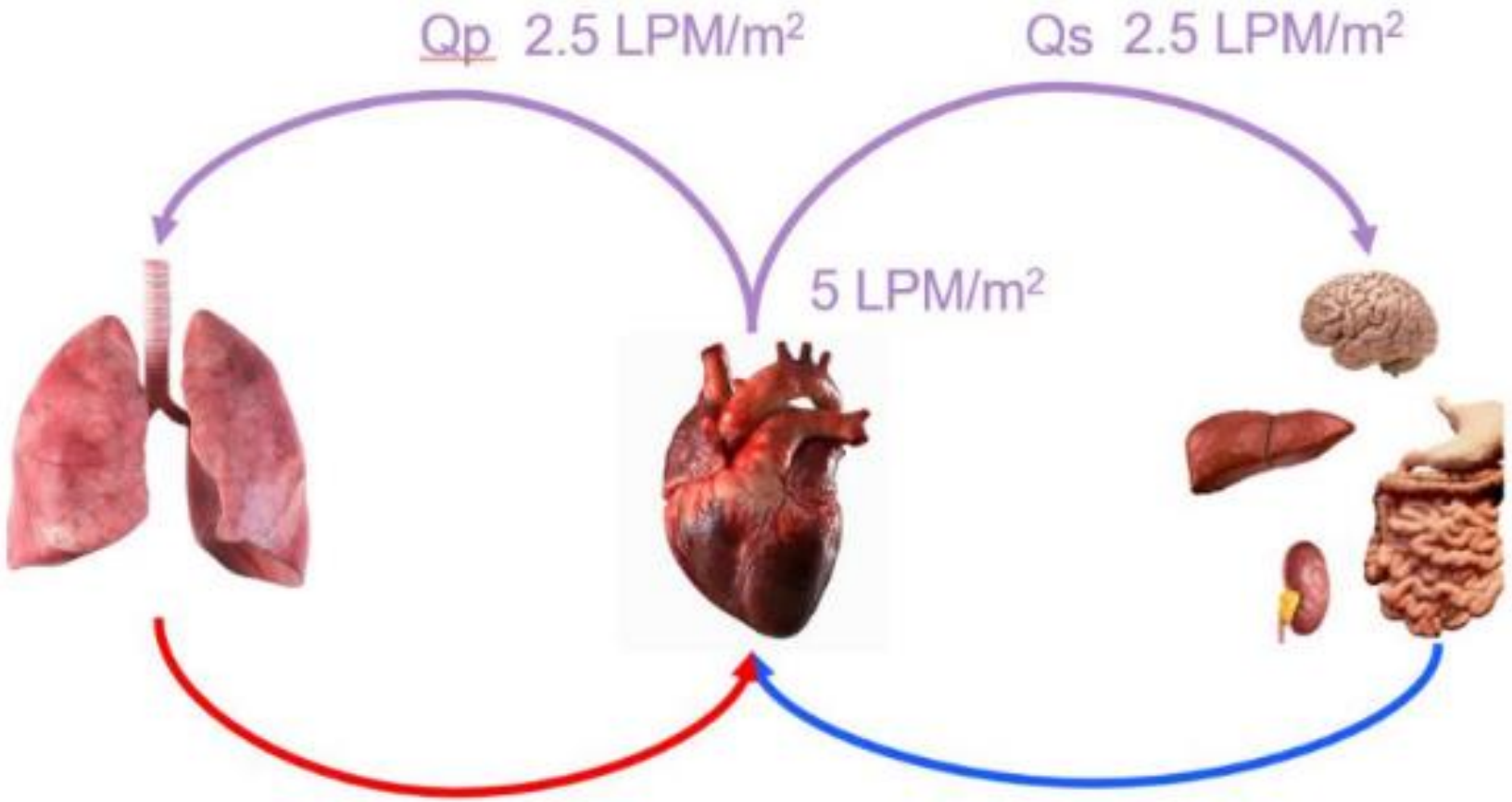


Oxygen needs and delivery

- **DO_2**
  - Amount of oxygen delivered to the tissues by the blood per minute.
    - How much oxygen is available for the tissues to use.

- **VO_2**
  - Volume of Oxygen consumed) is the amount of oxygen used by the body's tissues per minute.
    - How much oxygen your body is actually using.

Pulmonary over circulation



Pulmonary Over circulation- Physiology

Determinants of shunt flow:

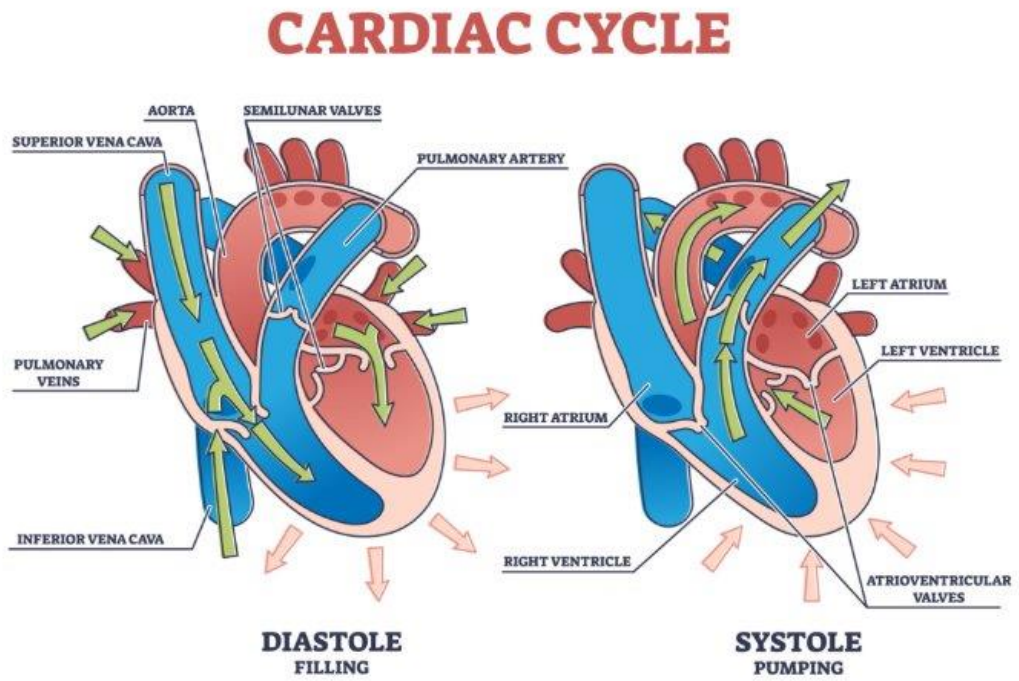
- Shunt size (defect diameter, duct size)
- Pressure gradient between chambers or vessels
- Resistance
- PVR
    - Falls after birth (key physiologic trigger)
    - Rises with hypoxia/acidosis

Too much blood flow to the lungs (Qp↑)

- Left-to-right shunt
- Lungs get flooded with flow → pulmonary edema/congestion
- Heart works harder → tachycardia, cardiomegaly, heart failure
- Systemic output can drop → poor perfusion, poor growth

Congestive Heart Failure (CHF) Basics

- **Congenital** or **acquired**
- **Right** or **left** (or combination)
- **Systolic** or **diastolic** (or combination)
- **Clinical syndrome** not a diagnosis
- Often **compensated** before its obvious
- Symptoms vary by **age**



Heart failure = the heart cannot meet the body's metabolic demands

Systolic Heart Failure (Pump problem)

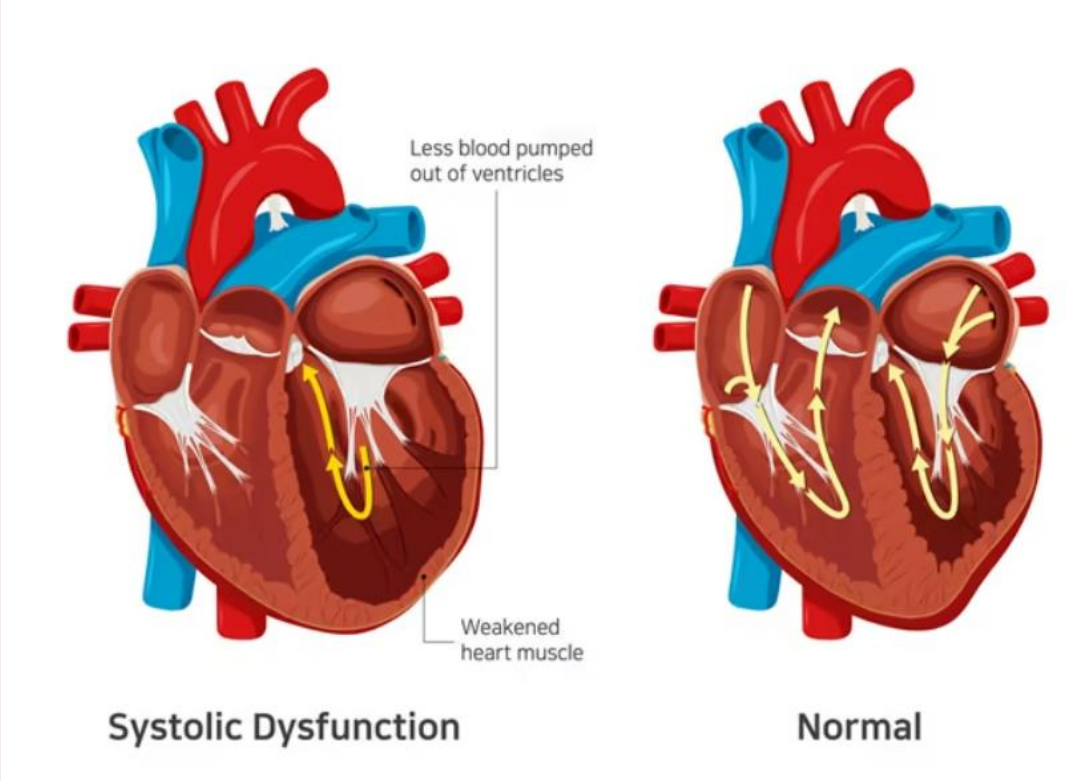
Definition:

The heart cannot contract effectively

Key physiology:

- ↓ Contractility
- ↓ Stroke volume
- ↓ Ejection fraction

Think: *Weak squeeze*



Systolic Heart Failure- Nursing Clues

Common findings:

- Tachycardia
- Poor feeding (infants)
- Fatigue with activity
- Cool extremities
- Delayed cap refill
- Low urine output

Diastolic Heart Failure (Filling problem)

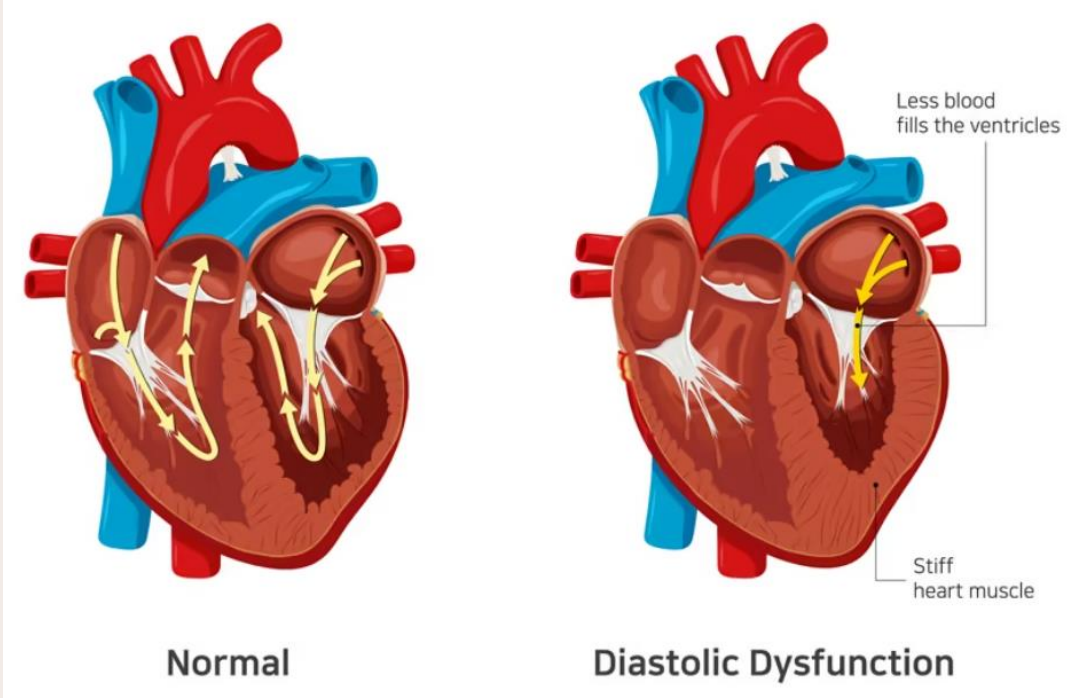
Definition:

The heart cannot relax or fill properly

Key physiology:

- Stiff ventricle
- Normal or preserved EF
- High filling pressures

Think: *Strong squeeze, no room to fill*



Diastolic Heart Failure- Nursing Clues

Common findings:

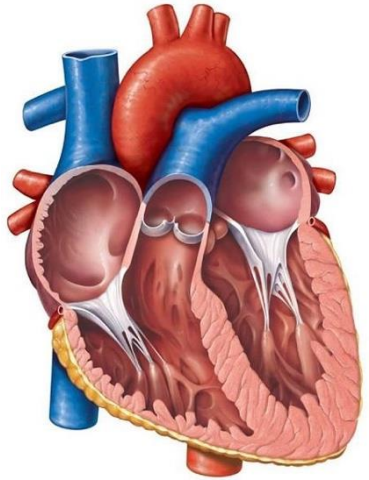
- Tachypnea
- Pulmonary congestion
- Crackles
- Hepatomegaly
- Edema
- Rapid desaturation with stress

heart failure

systolic vs. Diastolic comparison

DIASTOLIC HEART FAILURE "can't fill"	SYSTOLIC HEART FAILURE "can't pump"
ventricle unable to relax normally	ventricle unable to contract normally
heart can't properly fill with blood during diastole	can't pump with enough force to provide adequate blood into circulation
leads to fluid backing up into lungs	eventually causes low cardiac output
preserved ejection fraction	ejection fraction decreased

heart failure
right vs. left compared



Right heart failure

Systemic congestion

- hepatomegaly
- peripheral edema
- weight gain
- jugular venous distension
- pleural effusion

Left heart failure

Decreased cardiac output

- tachycardia
- gallop
- diaphoresis
- decreased perfusion
- fatigue
- poor feeding

Pulmonary congestion

- tachypnea
- cyanosis
- respiratory distress
- pulmonary edema
- wheezing
- cough

heart failure management

Improve Cardiac Function	Fluid Management	Decrease Metabolic Demands	Improve Tissue Oxygenation
Oral medications • ACE inhibitors • Beta blockers • Digoxin • Iron supplementation **Vasoactive infusions** • Milrinone • Epinephrine /Adrenaline • Dopamine Manage HTN Reduce afterload	• Diuretics • Strict I&O • Monitor electrolytes closely • Fluid and sodium restriction • Max concentrate calories	• Conservation of energy • Normothermia • NG feeds	• Reduce work of breathing • Treat anemia • Possibly O2 or other respiratory support • Mechanical ventilation

Case Study #1

- 4mo infant referred from rural clinic to regional hospital
- **History:** Mom reports last month breathing hard and fast, taking longer to feed, sweating with feeds
- **Vitals:** HR 160s, RR 60s, BP 80/45, O2 sats 96%
- **Physical Exam**
    - Thin infant with poor weight gain
    - Tachypnea with subcostal retractions
    - Harsh holosystolic murmur at the left lower sternal border*
    - Mild hepatomegaly

Case Study #1

- **What is happening?**
    - Heart failure secondary to pulmonary over circulation from a congenital heart disease
    - LV->RV->Lungs
    - Too much pulmonary blood flow= increased work of breathing, volume overloads the heart
    - Poor feeding=failure to thrive

Management:

- Furosemide, enalapril
- High calorie nutrition
- Echo for potential surgical repair

Cardiomyopathy

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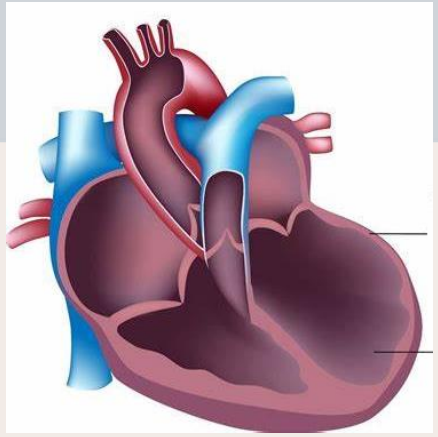
Cardiomyopathy

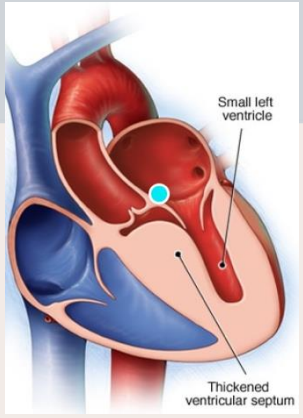
Dilated

- #1 cause of CHF in kids w/o structural abnormalities
- Typically idiopathic (no known cause at presentation)
- Metabolic / toxic = infectious symptoms may complicate clinical picture



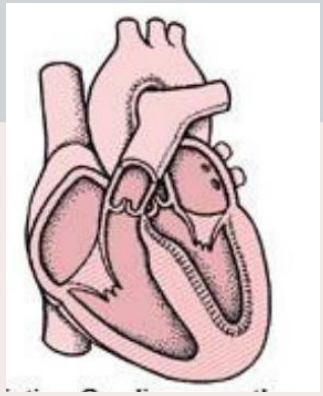
Hypertrophic

- Concern for LVOTO!
- Chest pain/syncope on exertion
- avoid tachycardia (beta blockers, Ca channel blockers)
- consider surgical resection or transplant
- Anticoagulation, AICD **– high risk for sudden cardiac death!**



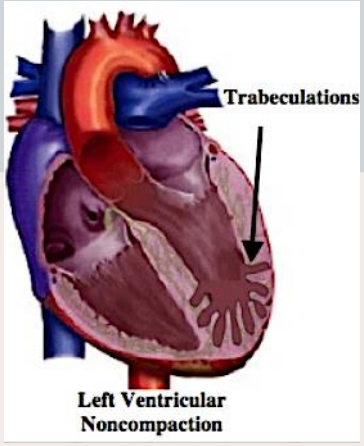
Restrictive

- Primary = genetic defect
- Progressive disease w/ poor prognosis
- ↓ congestion (diuretics – but preload dependent)
- Antiarrhythmics / avoid tachycardia
- Transplant candidacy

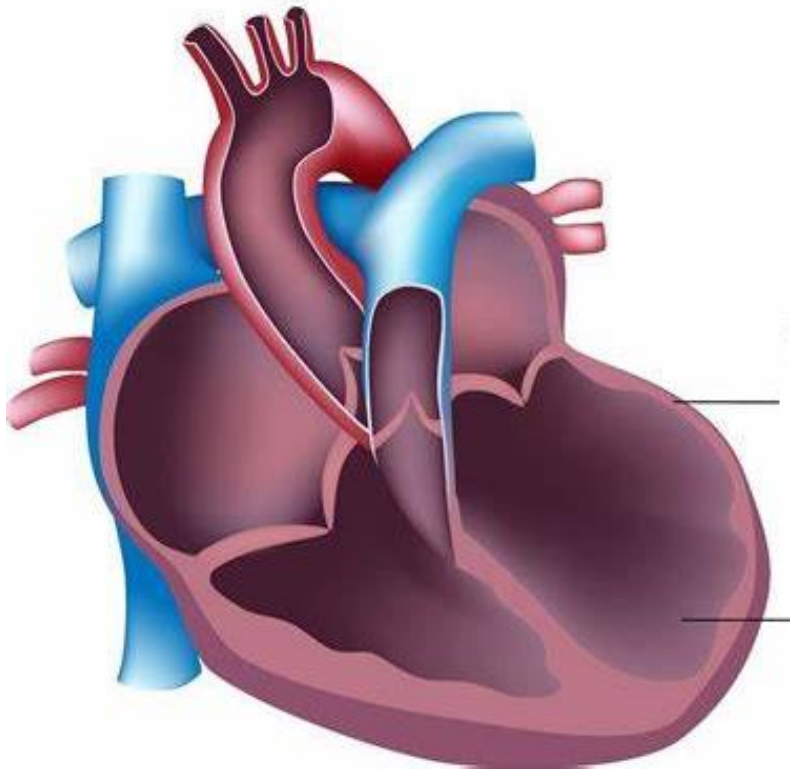


LV Non-compaction

- associated with HF, thromboembolism & ventricular arrhythmias
- Overall better outcomes
- VT onset=poor prognosis



cardiomyopathy etiologies dilated (DCM)



Pathophysiology:

- #1 cause of CHF in kids w/o structural abnormalities
- Typically idiopathic (no known cause at presentation)
- Primary = genetic abnormality in myocytes
- Secondary = various sources of insult (viral, toxic, endocrine, ischemic, metabolic)

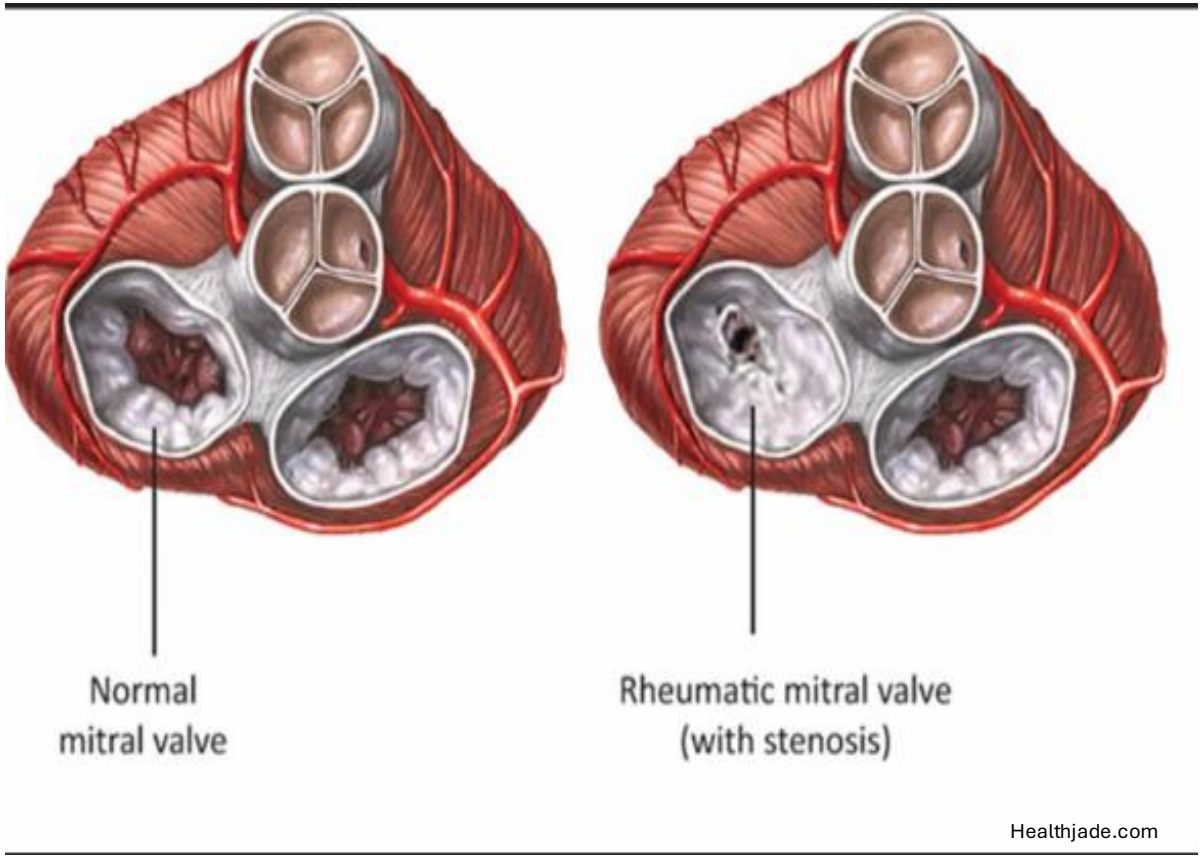
Clinical Presentation:

- HF symptoms r/t **impaired systolic fxn & contractility**
  - Poor weight gain/FTT
- Metabolic / toxic = infectious symptoms may complicate clinical picture
- Tachyarrhythmias

Management:

- ↓ Congestion & optimize CO (diuretics, inotropes)
- ↑ DO2 (O2, Hgb, afterload reduction)
- ↓ VO2 (sedation / analgesia / paralytics, ↓ metabolic demands)
- Antiarrhythmics & anticoagulants

Rheumatic heart disease



Disease pathway:

- Untreated Group A streptococcus throat infection
- Repeat inflammation damages the heart valves (mitral)
- Leads to mitral stenosis, mitral regurgitation, aortic valve disease= volume/pressure overload of the heart

Clinical Presentation:

- Short of breath, tachypnea, pulmonary crackles
- Poor weight gain, fatigue with eating
- New murmur, tachycardia

Management:

- Oxygen if needed
- Diuretic for pulmonaryy congestion (furosemide)
- Afterload reduction (enalapril)
- Treat anemia and infection
- Benzathine penicillin to prevent recurrence

Key Takeaways

Call the provider for:

- New or worsening tachycardia
- Increased work of breathing
- Decreased urine output
- Poor feeding
- Sudden fatigue or lethargy
- New arrhythmias

Case Study #2

- **Patient:**
  - 8-year-old boy from a rural village outside Lusaka
- **Chief Complaint:**
  - Progressive shortness of breath and fatigue for 3 weeks.
- **History**
  - Doesn’t keep up with peers while playing
  - Shortness of breathing
  - Poor appetite, swollen abdomen
  - 3 months earlier severe sore throat and fever- medically treated
  - No known heart disease

Case Study #2

- **Vital signs:** HR: 130 bpm RR: 36, BP: 90/55, O2 sats 92%
- **Physical exam**
    - Appears fatigued and mildly distressed
    - Tachypnea with mild retractions
    - Holosystolic murmur heard best at the apex
    - Hepatomegaly
    - Mild bilateral lower extremity edema
    - Crackles at lung bases
- **What is your diagnosis?**

Case Study #2

- **Decompensated heart failure**
  - Rheumatic heart disease with mitral regurgitation following untreated streptococcal infection
- **Management**
  - Furosemide for pulmonary congestion
  - Enalapril for afterload reduction
  - Spironolactone
  - Echo to evaluate for rheumatic heart disease, assess valve integrity
  - Begin benzathine penicillin prophylaxis

Questions???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