Chapter 26

The Child with a Cardiovascular Disorder

Objectives

- Distinguish the difference between the cardiovascular system of a child and an adult.
- List the general signs and symptoms of congenital heart disease.
- Differentiate among patent ductus arteriosus, coarctation of the aorta, atrial septal defect, ventricular septal defect, and tetralogy of Fallot.
- Discuss six nursing goals relevant to the child with heart disease.

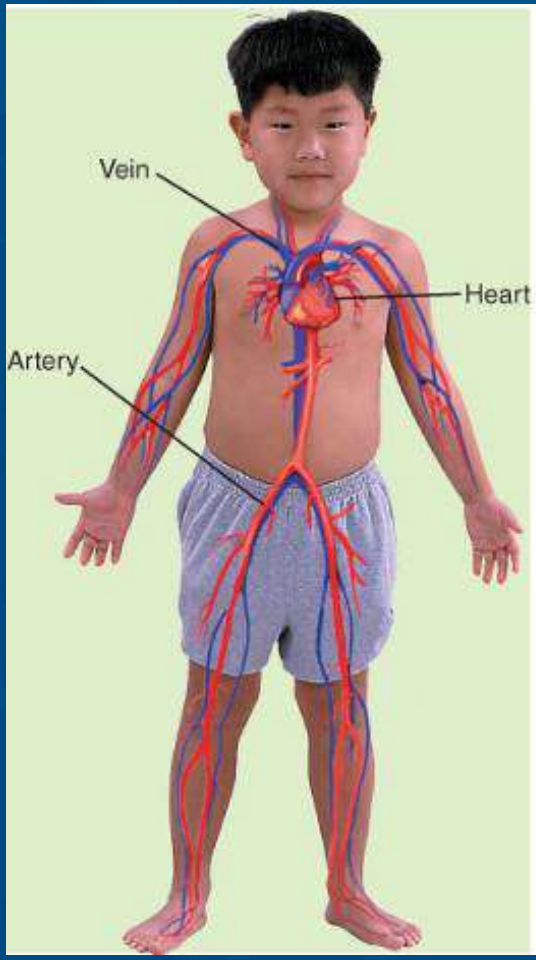
Objectives *(cont.)*

- List the symptoms of rheumatic fever.
- Discuss the prevention of rheumatic fever.
- Discuss hypertension in childhood.
- Differentiate between primary and secondary hypertension.

Objectives *(cont.)*

- Identify factors that can prevent hypertension.
- Recognize the manifestation of Kawasaki disease and the related nursing care.
- Describe heart-healthy guidelines for children older than 2 years.

Cardiovascular System



CARDIOVASCULAR SYSTEM

- Pulse, respiration, blood pressure, and hematologic values vary with the age of the child.
- Chest walls are thin in infants and young children because of the relative lack of subcutaneous and muscle tissue compared with older children. "Innocent" murmurs can be heard in structurally normal hearts.
- The newborn's circulation differs from fetal circulation; if adaptations do not take place, congenital heart problems may arise.
- Capillary function is immature in newborns. It takes several weeks for the small capillaries to expand and contract in response to external temperatures.
- The heart rate is higher in newborns and infants than in adults.
- Children have limited ability to increase stroke volume in response to decreased cardiac output.
- Most heart conditions in children result from defects in embryonic structure.

Signs Related to Suspected Cardiac Pathology

- Failure to thrive and/or poor weight gain
- Cyanosis, pallor
- Visually observed pulsations in the neck veins
- Tachypnea, dyspnea
- Irregular pulse rate
- Clubbing of fingers
- Fatigue during feeding or activity
- Excessive perspiration, especially over forehead

Congenital Heart Disease

- Occurs in approximately 8 out of 1,000 births
- 50% of these infants show signs/symptoms within the first year of life
- Can be caused by genetic, maternal, or environmental factors
  - Not a problem for the fetus because of the fetal-maternal circulation
  - At birth, the infant's circulatory system must take over and provide the child's oxygen needs

Congenital Heart Disease *(cont.)*

- Of the congenital anomalies, heart defects are the principal cause of death during the first year of life
- Diagnostic studies vary from noninvasive, such as an electrocardiogram, to invasive, such as angiogram
- Once diagnosis is confirmed, most cardiac defects require surgical intervention

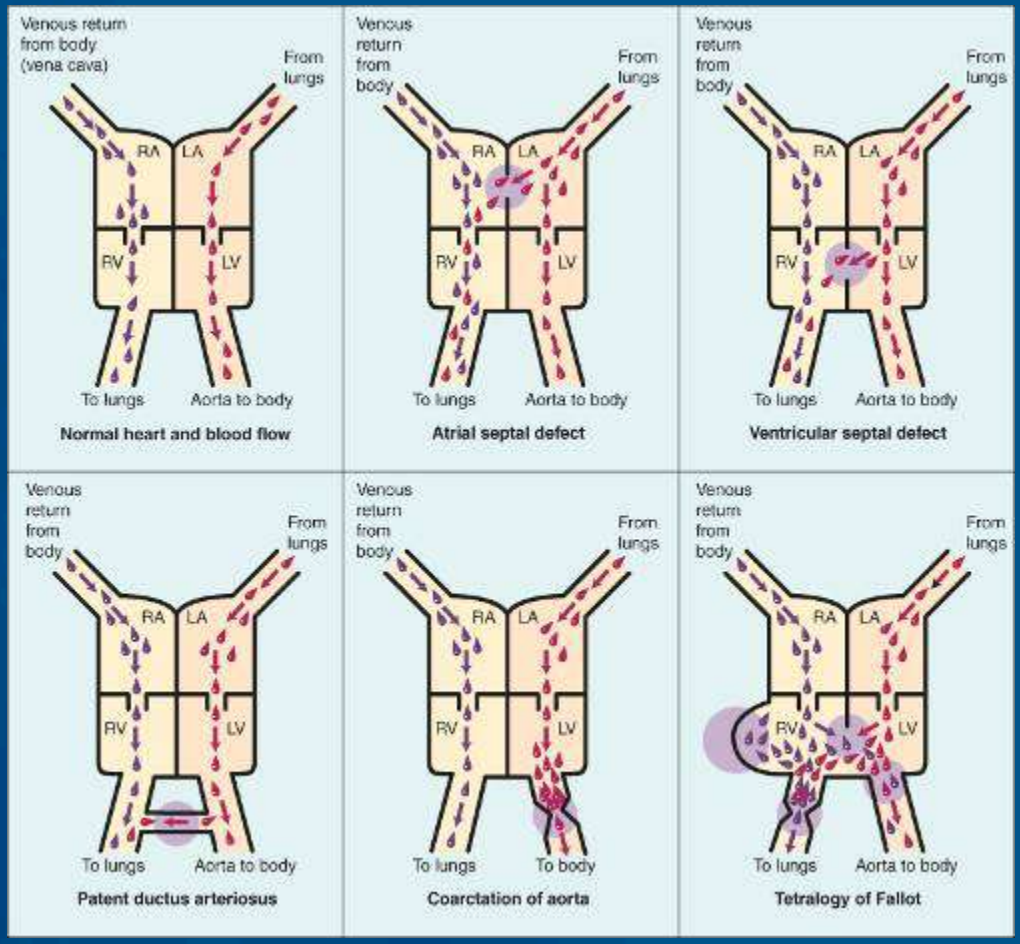
Congenital Heart Disease *(cont.)*

- Classification
- Two categories
  - Cyanotic
  - Acyanotic
- Blood always flows from area of high pressure to an area of low pressure and it also takes the path of least resistance

Congenital Heart Disease *(cont.)*

- Physiologically, defects can be organized into lesions that
  - Increase pulmonary blood flow
  - Obstruct blood flow
  - Decrease pulmonary blood flow
- A *shunt* refers to the flow of blood through an abnormal opening between two vessels of the heart

The Normal Heart and Various Congenital Heart Defects



Congenital Heart Disease *(cont.)*

- Defects that increase pulmonary blood flow
  - Blood returns to the right ventricle and recirculates through the lungs before exiting the left ventricle through the aorta
- Some defects that increase pulmonary flow are
  - Atrial septal defect
  - Ventricular septal defect and patent ductus arteriosus
- The oxygenated blood recirculates to the lungs, and cyanosis is rare

Nursing Tip

- In congenital heart disease, cyanosis is *not* always a clinical sign

Restrictive Defects

- Restriction usually from some form of stenosis of the vessel
  - Coarctation of the aorta
    - Narrowing or constriction of the aortic arch or of the descending aorta
    - Hemodynamically, increased pressure proximal to the defect and decreased pressure distally

Coarctation of the Aorta

- Characteristic symptoms
- Marked difference in the blood pressure and pulses of the upper and lower extremities
- May not develop symptoms until late childhood
- Treatment is dependent upon type and severity of the defect
- Best time for surgical intervention is between 2 and 4 years of age

Coarctation of the Aorta *(cont.)*

- If left untreated
  - Hypertension
  - Congestive heart failure
  - Infective endocarditis may occur
- After surgery, the nurse should observe for
  - Hypertension
  - Abdominal pain associated with nausea and vomiting
  - Leukocytosis
  - GI bleeding or obstruction
- Treatment includes
  - Antihypertensive drugs
  - Steroids
  - NG tube for decompression of the stomach

Defects that Decrease Pulmonary Blood Flow

- Occurs when a congenital heart anomaly allows blood that has not passed through the lungs (unoxygenated blood) to enter the aorta and general circulation
- Cyanosis caused by the presence of unoxygenated blood in the circulation is a characteristic feature of this type of congenital heart anomaly

Tetralogy of Fallot

- Four defects
  - Stenosis or narrowing of the pulmonary artery
    - Decreases blood flow to the lungs
  - Hypertrophy of the right ventricle
    - Enlarges because it must work harder to pump blood through the narrow pulmonary artery
  - Dextroposition of the aorta
    - The aorta is displaced to the right and blood from both ventricles enters it
  - Ventral septal defect (VSD)

Tetralogy of Fallot *(cont.)*

- Cyanosis increases with age
- Clubbing of fingers and toes
  - Due to chronic hypoxia
- Child rests in a "squatting" position to breathe more easily by altering systemic venous return
- Prevalent symptoms include
  - Feeding problems
  - Failure to thrive
  - Frequent respiratory infections
  - Severe dyspnea on exertion
  - Polycythemia develops to compensate for the lack of oxygen

Paroxysmal Hypercyanotic Episodes

- Known as *Tet spells*
- Occur during the first 2 years of life
- Spontaneous cyanosis, respiratory distress, weakness, and syncope occur
- They can last up to a few hours and are followed by lethargy and sleep
- Place child in knee-chest position when Tet spell occurs

Tet Position

Diagnosis

- Diagnosis confirmed by chest X-ray that shows a typical boot-shaped heart
- Additional tests include
  - EKG
  - 3-D echocardiography
  - Cardiac catheterization

Complications and Treatments

- Complications
  - Cerebral thrombosis caused by polycythemia, especially if dehydration occurs
  - Iron-deficiency anemia due to decreased appetite and increased energy required to suck or eat
  - Bacterial endocarditis can occur
- Treatment
  - Designed to increase pulmonary blood flow to relieve hypoxia
- Surgery
  - In some cases, IV prostaglandin E therapy can open a constricted ductus arteriosus and allow for oxygenation of the body until surgery is performed

Defects that Cause Mixed Pathology

- Hypoplastic left heart syndrome
  - Underdevelopment of the left side of the heart
  - Usually results in an absent or nonfunctional left ventricle and hypoplasia of the ascending aorta
  - Can be diagnosed before birth and infant is placed on a heart transplant list early

Defects that Cause Mixed Pathology *(cont.)*

- Hypoplastic left heart syndrome *(cont.)*
  - Initial survival depends on a patent foramen ovale and ductus arteriosus to provide a pathway for oxygenated blood to the general body system
  - Symptoms include
    - A grayish-blue color of the skin and mucous membranes
    - Signs of CHF
    - Dyspnea
    - Weak pulses
    - Cardiac murmur

General Treatment and Nursing Care

- Assorted medical and surgical treatments are currently available
- After the procedure, the nursing care involves
  - Monitoring vital signs
  - Observing for thrombosis formation
  - Neurovascular checks of the limb
  - Emotional support to child and family

General Treatment and Nursing Care *(cont.)*

- Instruct parents that children with congenital heart disease should avoid competitive sports because the pressure for a team win can interfere with the child's need to stop activity if specific symptoms arise
- Nutritional guidance aimed at preventing anemia and promoting optimal growth and development
- Vacations to high altitudes or very cold environments may cause adverse responses in a child who is already hypoxic or has cardiac problems

Acquired Heart Disease

- Occurs after birth
- May be a complication of a congenital heart disease or a response to respiratory infection, sepsis, hypertension, or severe anemia
- *Heart failure* is a decrease in cardiac output necessary to meet the metabolic needs of the body

Congestive Heart Failure (CHF)

- Manifestations depend on the side of the heart affected
  - Right side of the heart moves unoxygenated blood to the pulmonary circulation
    - A failure results in the backup of blood in the systemic venous system
  - Left side of heart moves oxygenated blood from the pulmonary circulation to the systemic circulation
    - Failure results in backup into the lungs

Congestive Heart Failure (CHF) *(cont.)*

- When body tries to compensate
  - Peripheral vasoconstriction occurs
  - Results in cold and/or blue hands and feet
  - Tachycardia
  - Tachypnea

Safety Alert

- Early signs of CHF in infants that should be reported
  - Tachycardia at rest
  - Fatigue during feedings
  - Sweating around scalp and forehead
  - Dyspnea
  - Sudden weight gain

CHF Goals of Treatment

- Goals
  - Reduce the work of the heart
  - Improve respiration
  - Maintain proper nutrition
  - Prevent infection
  - Reduce the anxiety of the patient
  - Support and instruct the parents

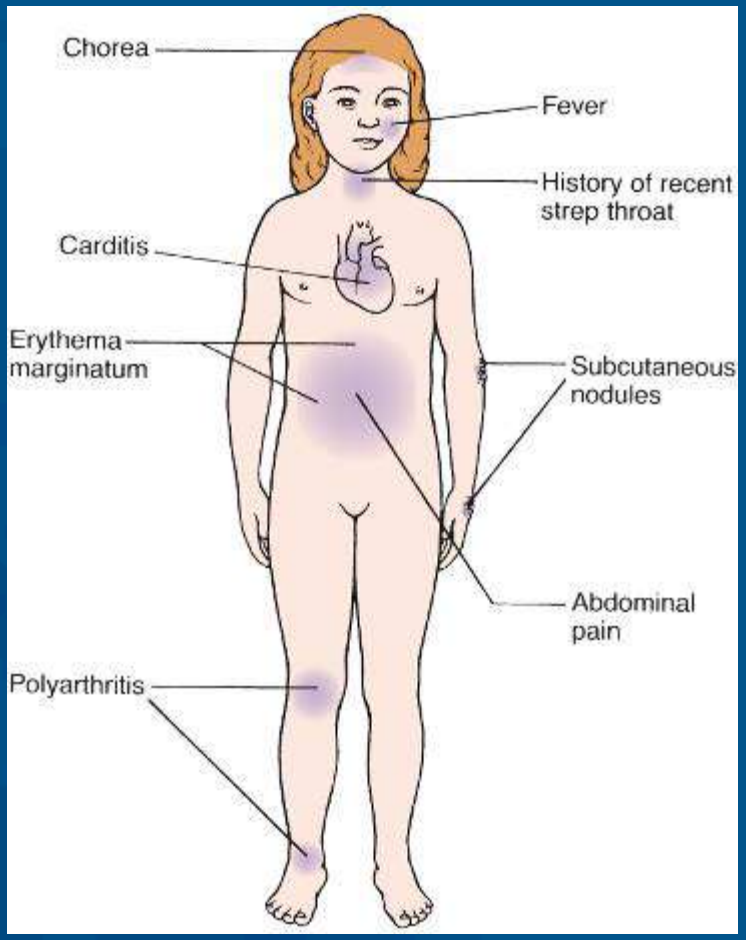
CHF and Nursing Care

- Organize care so that infant is not unnecessarily disturbed
- Feed early if crying and late if asleep
- Feedings are small and frequent
- Oxygen is administered to relieve dyspnea
- Medications are given as prescribed, after dosages are checked for safety
- Accurate recording of intake and output

Rheumatic Fever (RF)

- Systemic disease involving the joints, heart, central nervous system, skin, and subcutaneous tissues
  - Belongs to a group of disorders known as *collagen diseases*
- Common feature is destruction of connective tissue
  - Scars mitral valve in the heart
- Peak incidence is 5 to 15 years of age
  - More prevalent in winter and spring
- Autoimmune disease occurring as a complication of an untreated group A beta hemolytic streptococcus infection of the throat

Manifestations of RF



Modified Jones Criteria

- Minor criteria
  - Fever
  - Arthralgia
  - Previous history of rheumatic heart disease
  - Elevated erythrocyte sedimentation rate
  - Leukocytosis
  - Altered PR interval on electrocardiogram
  - Positive C-reactive protein
- A positive diagnosis of RF cannot be made without the presence of two major criteria or one major and two minor criteria, *plus* a history of streptococcal infection

Modified Jones Criteria *(cont.)*

- Major Criteria
  - Carditis
  - Polyarthritis
  - Erythema marginatum
  - Chorea
  - Subcutaneous nodules

Treatment of RF

- Antimicrobial therapy initially, then followed by chemoprophylaxis monthly for a minimum of 5 years
- Rest
- Relief of pain and fever
  - Antiinflammatory agents
  - Steroids
  - Aspirin
- Management of cardiac failure, should it occur

Nursing Care of RF

- Care should be organized to ensure as few interruptions as possible to prevent tiring the patient
- Special attention should be given to skin and back care; good oral hygiene; and small, frequent feedings
- If dental therapy is needed, prophylactic antimicrobial treatment is required before the procedure

Prevention of RF

- Prevention of infection and prompt treatment of group A beta-hemolytic streptococcal infections
- Nurse stresses importance of completing all antimicrobial therapy as prescribed

Systemic Hypertension

- More prevalent during childhood and adolescence
- Significant hypertension (HTN) is considered when measurements are persistently at or above the 95th percentile for patient's age and sex
- Primary, or essential, HTN implies that no known underlying disease is present
- When the cause of hypertension can be explained by a disease process, it is known as secondary
  - Renal, congenital, vascular, and endocrine

Systemic Hypertension *(cont.)*

- Heredity, obesity, stress, and poor diet and exercise patterns are some of the contributing factors to the development of HTN
- HTN more prevalent in children whose parents have high blood pressure

Systemic Hypertension *(cont.)*

- Treatment and nursing care involve
  - Nutritional counseling
  - Weight reduction
  - Age-appropriate program of aerobic exercise
  - Adolescents should be counseled concerning the adverse effects of drugs, alcohol, and tobacco on blood pressure
- Focus of treatment of secondary HTN is the underlying disease causing the elevated blood pressure

Nonpharmacological Approach to HTN

- Aerobic exercise
- Reduce sedentary activities
- Weight reduction
- Dietary management
- Adequate intake of potassium and calcium
- Avoid smoking and those who smoke

Hyperlipidemia

- Refers to excess lipids (fat and fatlike substances in the blood)
- Lipoproteins contain lipids and proteins and include
  - *Low-density lipoproteins* (LDL) contain low amounts of triglycerides, high levels of cholesterol, and some protein
    - Carries cholesterol to the cells, which aids in cellular metabolism and steroid production
  - *High-density lipoproteins* (HDL) contain low amounts of triglycerides, little cholesterol, and high levels of protein
    - Carries cholesterol to the liver for excretion

Hyperlipidemia *(cont.)*

- Children with two consecutive blood cholesterol levels exceeding 170 mg/dL should be followed closely and offered nutritional guidance
  - Parental history of cholesterol levels exceeding 240 mg/dL or a family history of early cardiac death (under age 55 years) should have their cholesterol levels tested
- Dietary intake of no more than 300 mg of cholesterol per day and no more than 30% total dietary calories from fat are recommended
  - Children younger than 2 years of age should not have a fat-restricted diet, because calories and fat are necessary for CNS growth and development

Kawasaki Disease (KD)

- Also known as *mucocutaneous lymph node syndrome*
- Leading cause of acquired cardiovascular disease in the U.S.
- Usually affects children younger than 5 years of age
- May be a reaction to toxins produced by a previous infection with an organism such as Staphylococci
- Not spread from person to person

Kawasaki Disease (KD) *(cont.)*

- Diagnosis is made by clinical signs and symptoms, no specific lab studies
- KD causes inflammation of the vessels in the cardiovascular system
  - Weakens the walls of the vessels
- Often results in an aneurysm (an abnormal dilation of the wall of a blood vessel)
  - Aneurysms can cause thrombi (blood clots) to form, which can be life-threatening

Kawasaki Disease (KD) *(cont.)*

- Manifestations
  - Onset is abrupt with a sustained fever
    - As high as 104º F (40º C)
    - Does not respond to antipyretics or antimicrobials
    - Fever lasts for more than 5 days
  - Conjunctivitis without discharge
  - Fissured lips
  - A “strawberry tongue”
  - Inflamed mouth and pharyngeal membranes
  - Enlarged nontender lymph nodes

Kawasaki Disease (KD) *(cont.)*

- Erythematous skin rash develops
- Swollen hands and desquamation (peeling) of the palms and soles
- Child is very irritable
- May develop signs of cardiac problems

Kawasaki Disease (KD) *(cont.)*

- Treatment
  - IV gamma globulin, if given early, can prevent the development of coronary artery pathology
  - Salicylate therapy for antithrombus properties
  - Warfarin therapy may be prescribed if aneurysms are detected

Kawasaki Disease (KD) *(cont.)*

- Nursing care
  - Symptomatic and supportive
  - Parent teaching should be reinforced concerning need to postpone active routine immunizations for several months after the administration of immune globulin, which is an immunosuppressant
  - Long-term, low-dose aspirin therapy may be prescribed
    - Compliance may be a problem for any long-term regimen in which medications must be taken when the child feels "well."

Question for Review

- How does the squatting (Tet) position relieve dyspnea?

Review

- Objectives
- Key Terms
- Key Points
- Online Resources
- Review Questions