Neonatal Nursing Education Brief: How to Recognize a Suspected Cardiac Defect in the Neonate
https://www.seattlechildrens.org/healthcare-professionals/education/continuing-medical-nursing-education/neonatal-nursing-education-briefs/
Cardiac defects are commonly seen and are the leading cause of death in the neonate. Prompt suspicion and recognition of congenital heart defects can improve outcomes. An ECHO is not needed to make a diagnosis.
Cardiac defects, congenital heart defects, NICU, cardiac assessment

How to Recognize a Suspected Cardiac Defect in the Neonate

Purpose and Goal: CNEP # 2092

- Understand the signs of congenital heart defects in the neonate.
- Learn to recognize and detect heart defects in the neonate.

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Requirements for successful completion:

- Successfully complete the post-test
- Complete the evaluation form

Date

- December 2018 – December 2020

Learning Objectives

- Describe the risk factors for congenital heart defects.
- Describe the clinical features of suspected heart defects.
- Identify 2 approaches for recognizing congenital heart defects.

Introduction

- Congenital heart defects may be seen at birth
- They are the most common congenital defect
- They are the leading cause of neonatal death
- Many neonates present with symptoms at birth
    - Some may present after discharge
- Early recognition of CHD improves outcomes

Congenital Heart Defects

- Congenital heart defects are also known as CHD
- CHD occurs in 6-13/1000 live births
    - 15% occur as cyanotic defects
    - 25-33% occur as critical defects
- Up to 58% of CHD may be diagnosed prenatally
    - Prenatal ECHO is highly variable
    - Its sensitivity depends on:
        - Operator expertise
        - Gestational age

        - Fetal position
        - Type of defect
- CHD may be referred to as:
    - Cyanotic CHD
    - Ductal-dependent CHD
    - Critical CHD
- When the diagnosis of CHD is delayed:
    - The risk of morbidity increases
    - The risk of mortality increases

Types of Congenital Heart Defects

- CHD may be classified as:
    - Cyanotic CHD
    - Ductal-dependent CHD
    - Critical CHD
- Cyanotic heart defects
    - Intra or extra cardiac shunting
    - Circulate deoxygenated blood
- Ductal-Dependent heart defects
    - Dependent on a patent ductus arteriosis
    - To allow mixing of blood
        - Oxygenated
        - Deoxygenated
    - Many cyanotic defects are ductal dependent
- Critical heart defects
    - Require intervention
        - Catheter intervention
        - Cardiac surgery

Risk Factors for Congenital Heart Defects

- There are several risk factors for CHD
    - Family history
    - Multiple fetuses

- Genetic syndromes
    - In 7-12% of CHD
    - Most common in:
        - Trisomy 21
        - Turner syndrome
        - DiGeorge Deletion 22q
- Maternal factors
    - Obesity
    - Diabetes
    - Epilepsy
    - Hypertension
    - Preeclampsia
    - Thyroid disorders
    - Phenylketonuria
    - Mood disorders
    - Connective tissue disorders
    - Advanced age >40
    - Alcohol or substance use
        - Amphetamines
    - First trimester tobacco use
    - Medications
        - NSAIDs
        - ACE inhibitors
        - Retinoic acid
        - Thalidomide
        - Phenytoin
        - Lithium
- *In utero* infections
    - Rubella
    - Coxsackie virus
    - Cytomegalovirus
    - Ebstein-Barr virus
    - Toxoplasmosis
    - Parvo virus B19
    - Herpes simplex virus
    - Flu-like illness
- Assisted reproductive technology
- There are several risk factors for ↑ survival

- Earlier diagnosis
- Lower birth weight
- Maternal age <30

Clinical Features of Congenital Heart Defects

- Some infants may present without symptoms
- Some present with immediate onset of symptoms
    - Shock
    - Cyanosis
    - Tachypnea
    - Pulmonary edema
- Shock may be seen in several types of CHD
    - Hypoplastic left heart syndrome
    - Critical aortic valve stenosis
    - Critical coarctation of the aorta
    - Interrupted aortic arch
- When infants present with shock:
    - Septic shock must be ruled out
    - Cardiogenic shock is suggested when:
        - Cardiomegaly is present on x-ray
        - Volume resuscitation is unsuccessful
- Cyanosis may be seen in several types of CHD
    - Pulmonary atresia
    - Ebstein’s anomaly
    - Truncus arteriosis
    - Tetralogy of Fallot
    - Ductal dependent lesions
    - Pulmonary valve atresia
    - Critical pulmonary valve stenosis
    - Hypoplastic left heart syndrome
    - Transposition of the great arteries
    - Total anomalous pulmonary venous return
- When infants present with cyanosis:
    - Non-cardiac causes must be ruled out
        - Sepsis

        - Pulmonary
        - Hypoglycemia
        - Dehydration
        - Hypoadrenalism
        - Rare causes:
            - Methemoglobinemia
            - Metabolic disorders
    - Cyanosis is suggested when:
        - Pulse oximetry saturations are <80s%
        - Pre and post-ductal saturations are different
            - A >3% difference is abnormal
- Tachypnea may be seen in several types of CHD
    - Truncus arteriosis
    - Patent ductus arteriosis
    - Large ventricular septal defects
    - Total anomalous pulmonary venous connection
- When infant s present with respiratory distress:
    - Non-cardiac causes must be ruled out
        - Sepsis
        - Pulmonary
        - Hypoglycemia
        - Dehydration
        - Abnormal forms of hemoglobin

When to Be Suspicious of a Heart Defect

- CHD should be suspected with:
    - Family history of CHD
    - Abnormal fetal ECHO
    - Failed CCHD screens
- CHD should also be suspected with:
    - Heart murmur
    - Central cyanosis
    - Comfortable tachypnea
    - Comfortable desaturations
    - Increased CRT >3 seconds

- Associated anomalies
    - Trisomy 21
    - Skeletal anomalies
        - Hand and arm
    - CHARGE syndrome
    - Ear anomalies
    - Renal anomalies

Initial Diagnosis of Congenital Heart Defects

- Initial diagnosis is based on:
    - History
    - Physical findings
    - Chest x-rays
    - Hyperoxia test
    - Echocardiogram
- History
    - Risk factors
    - Poor feeding
    - Color changes
    - Excessive irritability
    - Excessive sweating
    - Poor weight gain
    - Excessive sleeping
- Physical findings include:
    - Abnormal heart rate
    - Comfortable tachypnea
    - Abnormal heart sounds
    - Abnormal precordial activity
    - Abnormal oxygen saturation
        - <90% in any extremity
    - Oxygen saturation gradient
        - >3% difference in extremities
    - Blood pressure gradient
        - >10 mmHg higher in arms
        - >10 mmHg lower in legs

        - Abnormal femoral pulses
            - Weakened pulses
            - Absent pulses
        - Hepatomegaly
- Chest x-rays
    - Heart size and shape
        - Dextrocardia
        - Enlarged heart size
            - >60% of the chest
        - Boot shaped heart
        - Egg shaped heart
        - Snowman shaped heart
    - Pulmonary vascular markings
        - Decreased markings
            - ↓ pulmonary blood flow
        - Asymmetric markings
        - Pulmonary congestion
            - ↑ pulmonary blood flow
    - Site of the aortic arch
        - Left sided arch is normal
        - Right sided arch abnormal
- Hyperoxia test
    - Useful in ruling out pulmonary causes
        - Obtain an ABG in room air
            - Right radial artery
        - Provide 100% oxygen for 10 minutes
        - Obtain an ABG in oxygen
            - Right radial artery
            - An ↑ O2 should be seen
            - pO2 should be >150
        - No significant ↑ in O2 is abnormal
- Electrocardiograms
    - A large right ventricle is normal
        - Right ventricular hypertrophy
    - Other presentations suggest CHD
        - A small right ventricle is abnormal
        - A large left ventricle is abnormal
            - Left ventricular hypertrophy

Classification of Abnormal Heart Sounds

- Murmurs may or may or be associated with CHD
- Murmurs associated with CHD include:
    - ≥ grade 3 intensity
    - Holosystolic timing
    - Maximum intensity
        - At upper left sternal border
        - With upright positioning
    - Diastolic murmur
    - Harsh or blowing quality
- Grading of murmurs:
    - Grade 1 murmur
        - Faint sound detected
        - Often only audible to cardiologists
    - Grade 2 murmur
        - Soft murmur
        - Readily detected
    - Grade 3 murmur
        - Louder than grade 2
        - Not associated with palpable thrill
    - Grade 4 murmur
        - Easily detected murmur
        - Associated with palpable thrill
    - Grade 5 murmur
        - Very loud murmur
        - Easily audible with stethoscope
    - Grade 6 murmur
        - Extremely loud murmur
        - Easily audible with stethoscope off chest

Specific Congenital Heart Defect Care

- Specific care is indicated for infants who are:

    - Cyanotic
    - Fail a hyperoxia test
    - Do not have PPHN
    - Do not have lung disease on x-ray
- In most cases, these infants have:
    - Cyanotic heart disease
    - A ductal dependent heart defect
    - An increased risk of significant morbidity
    - An increased risk of death
- The ductus arteriosis must be kept open
    - To ensure mixing of oxygenated blood
    - To ensure mixing of deoxygenated blood
- Prostaglandin should be started prior to an ECHO
    - The initial dose should be 0.01 mcg/kg/min
    - Dosing may be ↑ to 0.05 mcg/kg as needed
    - A Cardiology consult should be obtained
- An ECHO is not needed to treat these infants
- Transfer to a referral center should be immediate

Echocardiogram Examination

- Echocardiogram imaging is definitive
- It provides information on cardiac:
    - Anatomy
    - Function
- It can also evaluate for pulmonary causes
- The ECHO should include:
    - Cardiac imaging
    - Pulsed Doppler flow
    - Color Doppler flow
- ECHOs should be done in consultation with a cardiologist
- All ECHOs should be interpreted by a pediatric cardiologist

Summary

- CHDs are the most common defect in the neonate

- They are a leading cause of morbidity and mortality
- Early recognition and identification is critical
- Several clinical signs are suspicious for CHD
- Alert neonatal nurses can identify infants at risk

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