children's health

UT Southwestern
Pediatric Group

Nursing Assessment of the Pediatric Cardiology Patient

Agenda

- Children are NOT small adults
- Assessment
  - Normal Vital Signs in Pediatric Patients
  - ABCs
  - Primary Assessment
  - Focused Physical Assessment
    - National Heart Hospital Charting flowsheets
- Case Study
- Open forum about difficulties from adults to pediatrics

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How are children different than adults?

- **Weight-based** (The smaller the patient, the more pronounced the differences)
- **Higher cardiac output per kilogram** of body weight and more fluid requirements compared to adults
- More susceptible to dehydration and fluid imbalances
- **Increase in oxygen consumption** due to a higher respiratory rate and **higher metabolic rate**
- Smaller airways and more soft tissue
- Smaller/fewer alveoli and more dead space in lungs, limiting gas exchange
- More adipose tissue, smaller veins (difficult venous access)
- Different indicators of pain/discomfort

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Normal vital signs by age

AHA Vital Signs Badge Buddy

Age Group	Heart Rate (Awake)	Heart Rate (asleep)	Respiratory Rate	Systolic Blood Pressure	Diastolic Blood Pressure	Mean Arterial Pressure
Neonate (0-1 mo)	100-205	90-160	20-60	67-84	35-53	45-60
Infant (1 mo-12 mos)	100-180	90-150	30-53	72-104	37-56	50-62
Toddler (12 mo-2 years)	98-140	80-120	22-37	86-106	42-63	49-62
Preschool (3-5 years)	80-120	65-100	20-28	89-112	46-72	58-89
School Age (6-12 years)	75-118	58-90	18-25	97-115	57-76	66-72
Adolescent (13-17 years)	60-100	50-90	12-20	110-131	64-83	73-84
Adult (≥ 18 years)	60-100	50-90	12-18	110-131	64-83	73-84

Temperature		
Neonate	Less than 36.5° C (Abnormal)	More than or equal to 38.0° C (Abnormal)
All other ages	Less than 36.0° C (Abnormal)	More than or equal to 38.0° C (Abnormal)

Source: American Heart Association

A. 8-month-old patient asleep with HR 180
B. 2-day old patient asleep with a HR 180

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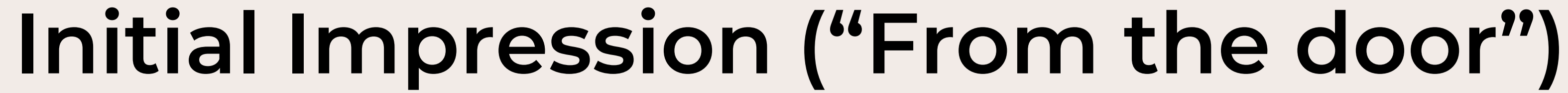

Airway:

- Level of Consciousness? Are they protecting their airway?
  - Unresponsive?
  - Irritable?

Breathing:

- Increased work of breathing?
- Absent or decreased respiratory effort?

Circulation:

- Abnormal skin color (cyanosis, pallor, mottled)

A. 10-year-old unrepaired TOF with 68% oxygen saturation and HB 21, mild increased WOB, cyanotic and clubbing
B. 3-year-old VSD repair post op day 5 with oxygen saturations 85% on room air, mild increased WOB, pale

Primary Assessment

Source: American Heart Association

Airway	Breathing	Circulation	Disability	Exposure
Clear	**Respiratory Rate & Pattern** Normal, Irregular, fast, slow, apnea	**Heart rate & Rhythm** Fast (tachycardic) Slow (bradycardic)	**AVPU** **A**lert Responds to **V**oice Responds to **P**ain **U**nresponsive	**Temperature** Normal, high, low
Maintainable	**Respiratory Effort** Normal Increased (nasal flaring, retractions, head bobbing, snoring)	**Pulses** Central (weak or strong) Peripheral	**Pupil Size (reaction to light)** Normal or Abnormal **Blood glucose** Normal, low, high	**Skin** (e.g rash, purpura) **Trauma** (e.g. bleeding)
Not maintainable	**Chest Expansion and Air Movement** Normal, decreased, unequal, prolonged expiration	**Capillary Refill** Normal or delayed?		
	Abnormal Lung Sounds & airway sounds Stridor, snoring, wheezing, grunting, crackles	**Skin Color & temperature** Pale, mottled, cyanotic, warm or cool		
	Oxygen Saturation Normal heart? > 94% Patient specific*	**Blood Pressure** Normal Hypo/hypertensive		

A. 4-year-old repaired ASD with HR of 150, BP 80/40, spO2 95%, RR 36, temperature 36.0, four second capillary refill, and *no void in 6 hours*
B. 6-month-old known PDA lethargic post feed, HR 130, BP 80/30, RR 30, SpO2 94%

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National Heart Hospital Assessment & Documentation

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Head-to-Toe Assessment

Focused Assessment
Respiratory/Oxygenation

- Maintaining their own airway?
  - Patency and is it at risk?
  - ETT size & length, position on CXR secure
- Ventilation mode and settings
  - PEEP, PS, TV (mls/kg), PS or PC, set FiO2
  - EtCO2 & SpO2

- Inspection
  - Rate/rhythm/depth & chest expansion
  - Auscultation: Breath sounds both inspiratory & expiratory & additional noises

Key differences in pediatrics vs adults

Faster respiratory rates
Retractions are an early sign of respiratory distress
Periodic breathing/irregularity is normal

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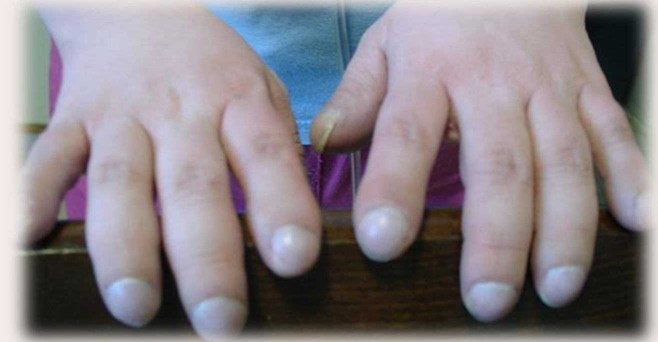
cardiovascular assessment
look & feel: perfusion

- Pulses
  - Central
  - Peripheral
- Capillary refill
  - Peripheral
  - Central
- Nailbeds & lip color: pink, pale, dusky, cyanotic, black, clubbing
- Skin temp & moisture
  - Temp influenced by environment & CO
  - Dry, moist, clammy, diaphoretic
    - *Diaphoresis*: at rest or with crying /feeding /activity?



- Edema
  - Central, pedal, periorbital
    - More common in periorbital, scrotal, sacral areas in infants
- Drips & Urine output
  - What infusions are the patient on?
  - Urine output ml/kg/hr (<1 ml/kg/hr could indicate poor perfusion)

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cardiovascular assessment

Key differences in pediatric vs adults

- **Higher heart rates**
- **Limited ability to increase their stroke volume**
- **Capillary refill time is a critical indicator of cardiac output**
- **Heart failure presents as poor feeding, failure to thrive, tachypnea, hepatomegaly**

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Focused Assessment
GI/Nutritional/Renal/Bowel elimination

- Continuous or Bolus feeds?
  - Difficulty breastfeeding or PO feeding
  - Difficulty gaining weight
- Abdominal Assessment
  - Bowel sounds audible?
  - Soft/hard/distended
  - Bowels open?

Key differences in pediatrics vs adults

- **Children have a higher per kilogram calorie, protein, and fluid requirement than adults**
- **Immature GI system can cause prolonged gastric emptying**
- **Growth charts**

Focused Assessment
Fluid/Electrolyte/Acid Base Status

- Maintenance IV fluid rate and calculation
  - 4-2-1 rule
- Intake & Output
  - Both oral and IV
  - Urine & Drain outputs
  - Remember insensible losses

Body weight categories	Estimated daily maintenance fluid volume	Estimated fluid rate per hour
Up to 10 kg	100 calories/kg/day or 100 ml/kg/day	4 ml/kg/h
10–20 kg	1,000 calories + 50 calories/kg/day or 1000 ml + 50 ml/kg/day for each kg over 10 kg	2 ml/kg/h
>20 kg	1,500 calories + 20 calories/kg/day or 1,500 ml + 20 ml/kg/day for each kg over 20 kg	1 ml/kg/h

Key differences in pediatrics vs adults

- **Children have a higher percentage of body weight**
- **More prone to dehydration**
- **Rapid shifts can occur with electrolytes**

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Focused Assessment
Skin

- Skin Integrity
  - Pressure areas
  - Access Site conditions
- Wounds
  - Conditions
  - Treatment/ Dressing changes

Key differences in pediatrics vs adults

- **Thinner epidermis and dermis (pressure injuries can be more common due to delicate skin and friction)**
- **More permeable to water, chemical microbes (infections & spread more quickly due to immature barrier and immune system)**
- **Much higher surface area-to-body weight ratio = greater exposure risk per kg**
- **Immature sweat glands = limited ability to thermoregulate**

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Focused Assessment
Neurological Assessment

- Neurological Status
  - AVPU
  - GCS
  - Pupils, PEARL
- Pain Control
  - Adequate pain regimen
  - Adequate sedation
  - Withdrawal assessment

Key differences in pediatrics vs adults

- **Developmental norms/delays**
- **Speech & language**
- **Coordination & cooperation may be limited**

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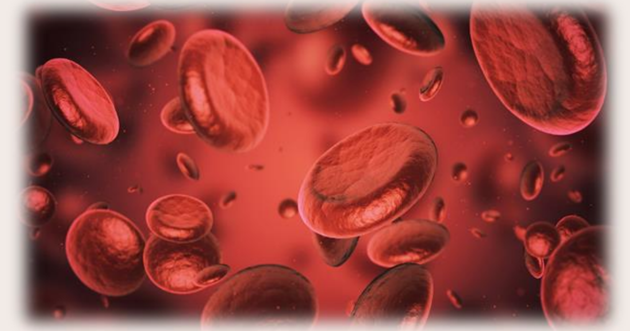
Focused Assessment
Hematology & Temperature regulation

- Hematology
  - H/H difference for each patient
  - T&S expiration
- Temperature
  - Can be influenced by environmental causes



Key differences in pediatrics vs adults

- **H/H Goals are different**
- **Core temp vs peripheral temperature**

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Case Study

Mercy, 4 y.o 20kg female with large VSD, and delayed developmental milestones
POD 3 from a VSD patch closure. Persistent accelerated junctional rhythm in the 140s. Started on amiodarone infusion @ 10mcgs/kg/min

8 hours after starting amiodarone for rate control, Mercy is lethargic, heart rate is 140s, she has cool and clammy peripheries, weak pulses, 4 second capillary refill, BP 40s/20s, lactate 7, no urine output for 4 hours.

What is happening?

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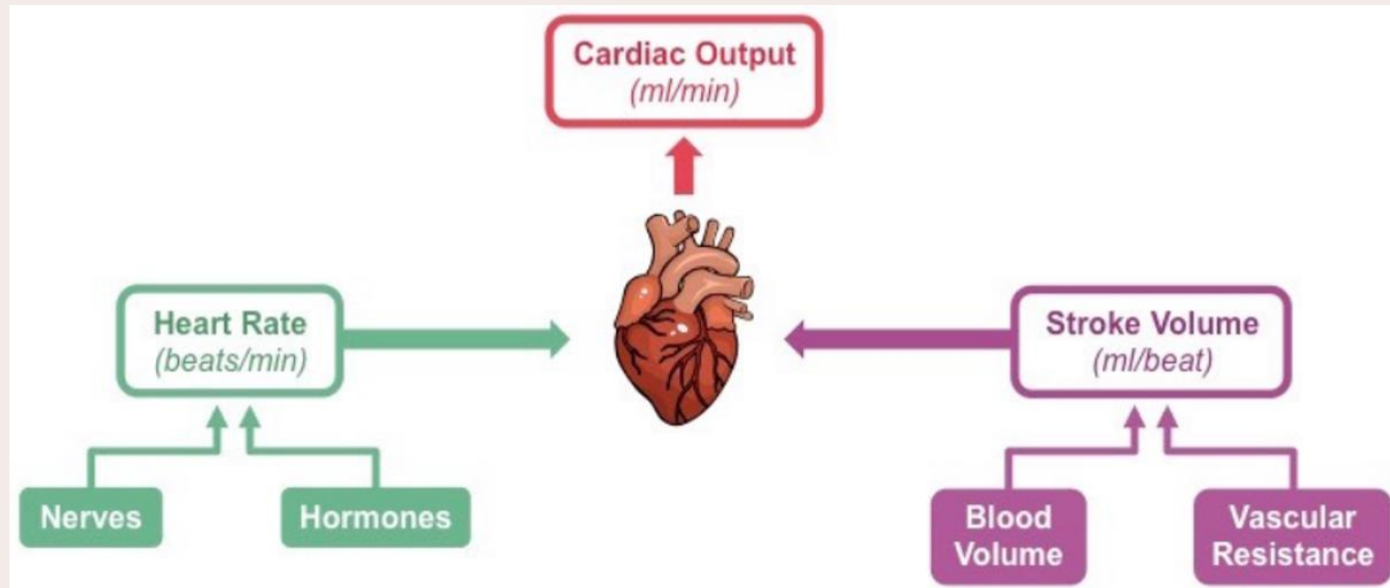
Cardiac Output = HR x SV



Stroke volume influence by:

- Preload
- Afterload
- Contractility

How do infants and young children increase their cardiac output?

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Cardiac Output = HR x SV 2

Infants and young children's ability to increase stroke volume in response to physical demands is **limited** compared to adults

Why?

- **Myocardium is less developed**
- **Infant ventricles are stiffer and don't stretch and fill as effectively**
- **Ability to increase contractility through sympathetic stimulation is reduced due to immature autonomic nervous system**
- **High heart rate at baseline shortens diastole (filling phase), which limits stroke volume further**

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how do we identify decreased cardiac output at the bedside?

ASSESSED "PERFUSION PARAMETERS" FOR CARDIAC OUTPUT IN PEDIATRICS

Perfusion Parameter	Adequate	Altered	Poor
Level of consciousness	Appropriate for age	Irritability	Unresponsive
Urinary output	>1 mL/Kg/hr	0.5 mL/Kg/hr	<0.5 mL/Kg/hr
Temperature	36.5–38° C	<36.5–>38° C	<36–>38.5° C
Quality of pulses	+2 (normal)	+3 to +4 (bounding)	+1 to absent
Capillary refill time	<2 seconds	2–4 seconds	>5 seconds

BUN/Creatinine
Liver function tests
Serum lactate

- Tachycardia
- Decreased peripheral pulses
- Cool, mottled extremities
- Prolonged capillary refill
- Altered level of consciousness
- Decreased SvO2
- Hyperthermia
- Central/peripheral temperature gradient
- Tachypnea
- Decreased UOP
- Hepatomegaly
- Decreased BP (late sign in children)

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Case Study 2

Mercy, 4 y.o 20kg female with large VSD, and delayed developmental milestones

POD 3 from a VSD patch closure. Persistent accelerated junctional rhythm in the 140s. Started on amiodarone infusion @ 10mcg/kg/min

8 hours after starting amiodarone for rate control, Mercy is **lethargic**, heart rate is **140s**, she has **cool and clammy extremities**, **weak pulses**, **4 second capillary refill, BP 40s/20s**, **lactate 7**, **no urine output for 4 hours**

Case Study 3

Assessment

- poor perfusion: pulses, cap refill, color, temperature
- tachycardia
- hypotension
- Increased lactate
- decreased urine output

Identify

- Low cardiac output state secondary to amiodarone infusion

Intervene

- Notify the doctor
- Stop amiodarone, prepare volume

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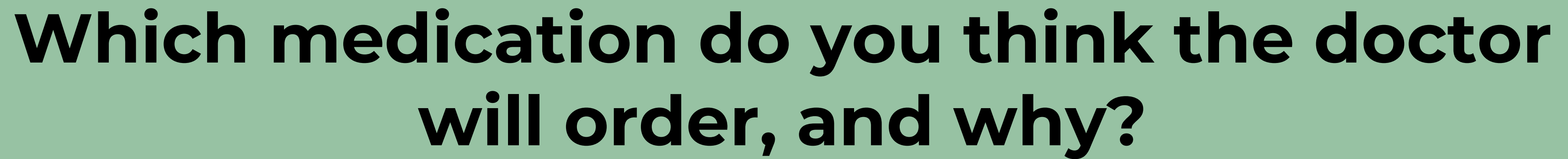

Which medication do you think the doctor will order, and why?

A. Adrenaline @ 0.05mcg/kg/min

B. Noradrenaline @ 0.05mcg/kg/min

Case Study 4

Adrenaline	Noradrenaline
Beta 1 agonists Increases contractility and heart rate Directly supports the heart by improving it's pumping ability	Alpha 1 agonists Causes vasoconstriction Increases Afterload Can further decrease CO

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Normal vital signs parameters

Open Forum

Management in post resuscitation

What are some difficulties for you transitioning from adults to pediatrics?

ABG results

PALS

Fluid calculation & Administration

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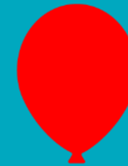
Take Home Points

- Pediatric Patients require a specialized assessment
- Primary Assessment provides crucial information
- An in-depth assessment and continuous monitoring is essential
- Nurses are the primary bedside advocate



What we do matters!

thank you

Becka's Cell phone
+1 901-417-1106

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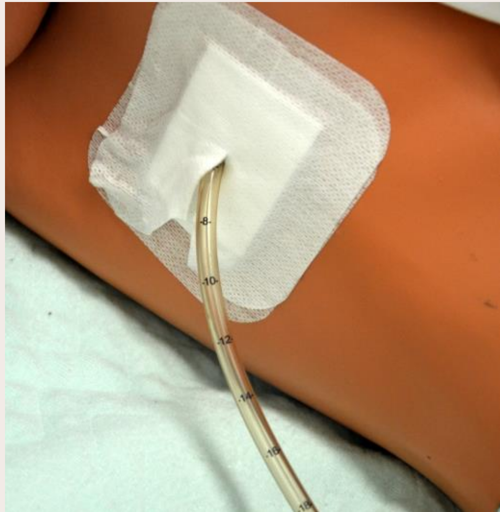

Next Learning Session
July 23rd @ 3:00 PM
Central Africa time

"Nursing Competencies"

Presented by: Sydney, Bailey & Katie

Pre-test Nursing Competencies

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