Exam 6 Study Guide

This guide covers the growing child and the child whose airway or heart is in trouble. First the scaffolding of pediatric nursing: how children grow and develop, what health promotion looks like at each age, and the two calculations that keep a child safe, the weight-based dose with its adult ceiling and the 4-2-1 fluid rate. Then the respiratory and cardiovascular conditions, built on one idea: children compensate well and then fail suddenly, so you read the trend and act on the first action that fits. Work one chapter at a time. Read the "what to know" paragraphs, study the tables, then try each worked case with the steps covered. Finish each chapter with its ten self-test items. The cram sheet at the end puts the numbers in one place.

WHAT THIS GUIDE COVERS

- Chapter 11 · cephalocaudal and proximodistal growth, critical periods, anthropometrics and growth charts, corrected age, growth faltering and BMI bands, growth by age, fontanelles, teeth, vision and hearing, organ maturation, Tanner staging and puberty thresholds, Erikson and Piaget, play and fears, milestones from 2 months to 5 years and red flags, feeding, vitamin D and iron, complementary foods and allergy, sleep, oral health and screens, immunization principles and false contraindications, anticipatory guidance, injury prevention by age, safeguarding, screening, dosing guard-rails, 4-2-1, dehydration, vital signs by age, compensated shock, PAT, PEWS, SBAR and delegation.
- Chapter 12 · airway resistance and the fourth-power law, chest wall and myocardium, vital signs and hypotension thresholds, dosing and fluids, the doorway triangle and red flags, croup, epiglottitis and tracheitis, foreign body aspiration, sleep apnea and tonsillectomy care, bronchiolitis and RSV prevention, asthma assessment and treatment, pneumonia, cystic fibrosis, transitional circulation and CCHD screening, prostaglandin E1, shunt lesions and Eisenmenger syndrome, obstructive lesions, cyanotic lesions and the tet spell, Kawasaki disease, rheumatic fever, endocarditis and myocarditis, heart failure and digoxin, shock, SVT and pediatric arrest.

CHAPTER 11

Pediatric Growth, Development and Health Promotion

Read it in full: **Chapter 11 in the textbook**. Practice it in the lab: **The Milestone Bench: Place It, Flag It, Approach It** and **Per Kilogram, Per Hour, Per Age Band**.

What to know

Growth is size; development is function. Growth is **cephalocaudal** (head to toe: head control before sitting before walking) and **proximodistal** (center outward: arm control before the pincer grasp), and moves from general to specific. The **sequence is fixed but the rate is individual**. Critical periods, such as the first three years for synapses and language, are the argument for early intervention. One measurement says little; a **plotted trajectory** says a lot.

Weigh in kilograms only. Measure length lying down until 2 years and height standing after; head circumference to at least 24 months. Use WHO charts from birth to 24 months and country charts (such as CDC) from 2 to 20 years. Plot preterm infants by **corrected age** (chronological age minus weeks born before 40). Sustained downward crossing of two major percentile lines, or weight-for-length below the 5th percentile, is **growth faltering**; avoid "failure to thrive." BMI-for-age from 2 years: under 5th underweight, 85th to 94th overweight, 95th or above obesity.

Birth weight doubles by 4 to 6 months, triples by 12 months and quadruples by 24 months. Length rises about 50 percent in the first year. The posterior fontanelle closes at about 2 to 3 months and the anterior at 12 to 18 months; assess with the infant calm and upright. The first tooth comes at 6 to 10 months; teeth equal age in months minus 6 up to about 2 years; all 20 primary teeth by about 30 months. Persistent eye misalignment beyond 4 months needs referral. Total body water is about 75 percent in the newborn, so diarrhea is dangerous. Thelarche (8 to 13 years) is the first sign of puberty in girls; menarche follows about 2 to 2.5 years later. Puberty before 8 (girls) or 9 (boys) is precocious; no breast budding by 13, no menarche by 15 or no testicular enlargement by 14 is delayed.

Erikson: infant trust (consistent caregivers), toddler autonomy (offer two real choices), preschool initiative (say plainly that nothing they did caused this), school-age industry (give them a job), adolescent identity (privacy and confidential time). **Piaget**: object permanence at 8 to 9 months explains separation anxiety; preschool thinking is magical and literal, so avoid words like "take"

your blood pressure or "kill" germs; concrete operations from 7 years; formal operations from 11. Play moves solitary, parallel, associative, cooperative. Stranger anxiety starts at 6 to 8 months; separation anxiety peaks at 10 to 18 months and moves through protest, despair and detachment, which can be misread as settling.

Infant motor: head up prone at 2 months, steady head control and rolling at 4, tripod sitting at 6, sitting alone and crawling at 9, cruising at 12, walking from 9 to 15 months. Fine motor: rake at 6 months, crude pincer at 9, neat pincer at 12. Language: coo at 2 months, babble 4 to 6, "mama/dada" at 9, 1 to 3 words at 12. The **social smile at 2 months** is a real milestone. Moro and tonic neck reflexes should be gone by 4 to 6 months. Hand preference before 12 to 18 months suggests weakness on the other side.

Toddlers: 10 to 25 words at 18 months, 50 or more and two-word phrases at 24 months (about 50 percent intelligible), 75 percent at 3 years. Toilet readiness belongs to the child. Preschoolers: tricycle and circle at 3, hop and cross at 4, skip and triangle at 5. **Red flags**: loss of any acquired skill at any age (urgent referral), no social smile by 3 months, poor head control at 4, not sitting at 9, no babbling, pointing or gesture by 12, no words by 16, no two-word phrases by 24, not walking by 18 months. **Check hearing first** when milestones lag.

Exclusive breastfeeding for about six months; iron-fortified formula is a complete alternative. **Vitamin D 400 IU daily** for breastfed infants; iron about 1 mg/kg/day from 4 months for term breastfed infants. Never prop a bottle or put one in the crib. Complementary foods at about 6 months, iron-rich first, one new food every 3 to 5 days, with early peanut introduction for high-risk infants. **No honey, cow's milk or juice before 12 months**; then whole milk capped at 480 to 720 mL a day. Quarter grapes lengthwise. Toddler appetite falls normally; the adult decides what and when, the child decides whether and how much.

Sleep needs fall from 14 to 17 hours in the newborn to 8 to 10 in adolescents. Infant safe sleep: supine, firm separate surface, room-share without bed-sharing for at least 6 months. Brush with fluoride toothpaste from the first tooth (rice-grain smear under 3, pea-sized from 3); first dental visit by 12 months. No screens besides video calls before 18 to 24 months; about one hour of co-viewed content from 2 to 5. **Immunize by chronological age at full dose**, even for preterm infants. Mild illness, antibiotics, prematurity and breastfeeding are not contraindications; true ones

include anaphylaxis to a prior dose or component. Infants under 12 months get IM shots in the vastus lateralis. Two live parenteral vaccines not given the same day need 4 weeks apart.

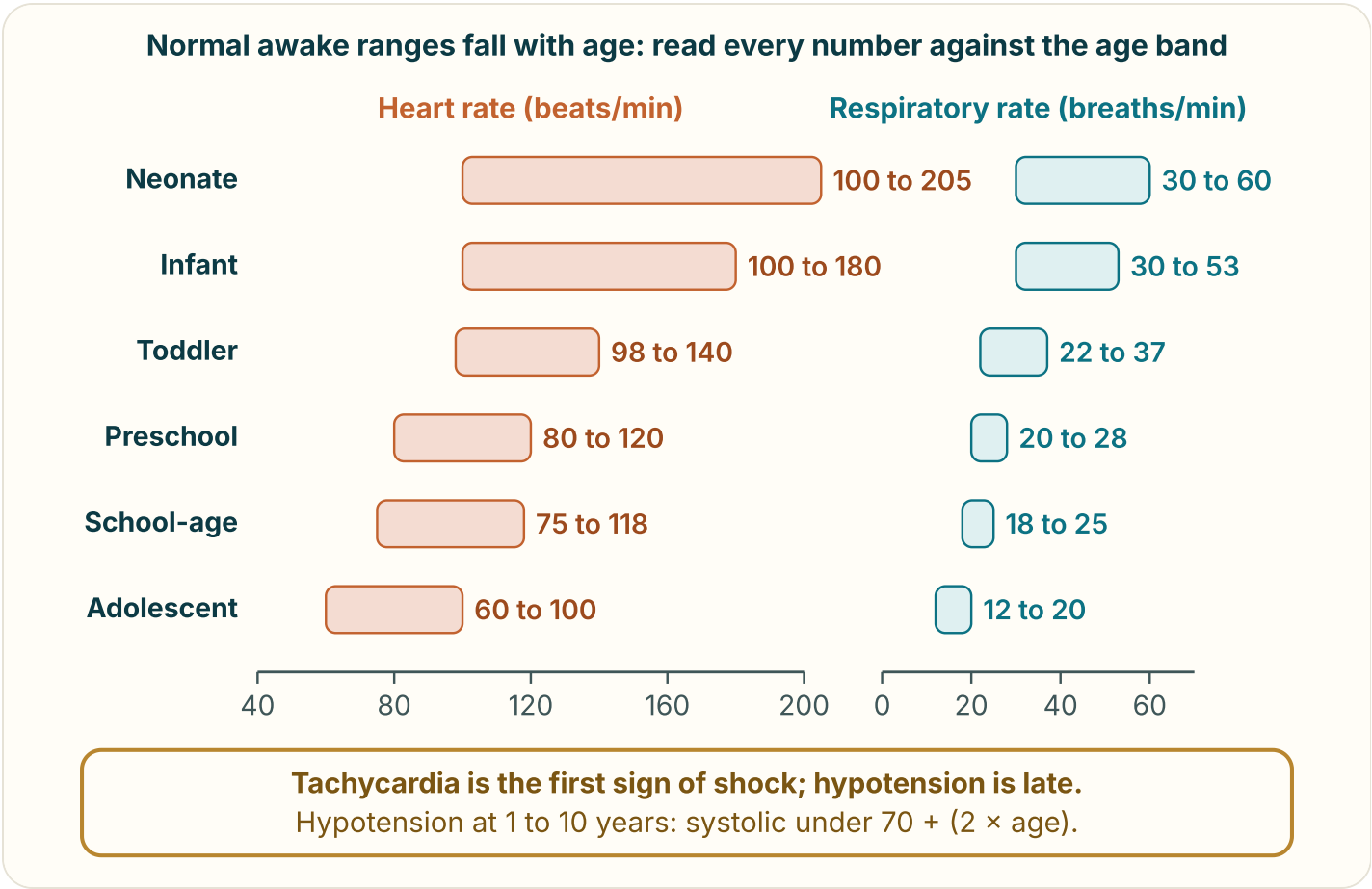
Anticipatory guidance teaches what is coming before it arrives: rolling and falls at 2 months, choking and poisoning at 6 months. Injury is the leading cause of death after age one, and each mechanism maps to a new capability. Car seats: rear-facing as long as the seat allows, then harness, then booster until the belt fits (about 145 cm), back seat until about 13. Drowning is the leading unintentional cause at 1 to 4 years: touch supervision and four-sided pool fencing. Water heater about 49 °C. Safeguarding: **"Does the injury fit the stage and the history?"** Bruising in a pre-mobile infant is a sentinel injury. Report on reasonable suspicion; the duty is personal. Teach doses with an oral syringe in milliliters, never teaspoons.

Dosing sequence: current weight in kg, safe mg/kg range, multiply, divide for doses per day, **compare with the adult maximum**, then convert to volume from the bottle in hand. Leading zero always, trailing zero never. Independent double checks for high-alert drugs. In an emergency without a tape, weight for ages 1 to 5 is about (age × 2) + 8. Maintenance fluid: **4-2-1** (4 mL/kg/h for the first 10 kg, 2 for the next 10, 1 for each kg above 20), using isotonic fluid. A shock bolus is **20 mL/kg** over 5 to 20 minutes, reassessed after each; 10 mL/kg for neonates, DKA, severe malnutrition and cardiac disease.

Dehydration: 1 kg of acute weight loss is about 1 L of deficit. Mild under 5 percent, moderate 5 to 10, severe over 10. ORS for mild is about 50 mL/kg over 4 hours, moderate 100 mL/kg over 4 hours, plus about 10 mL/kg per extra loose stool, in small frequent sips even with vomiting. Expected urine output is about 2 mL/kg/h in infants and toddlers, 1 in older children, 0.5 to 1 in adolescents.

Read vitals against the age band. **Tachycardia is the earliest sign of shock; hypotension is late**, often after 25 to 30 percent of volume is lost. Hypotension: under 60 in a term neonate, under 70 in infants, under 70 + (2 × age) from 1 to 10 years, under 90 over 10 years. Compensated shock: rising heart rate, capillary refill over 2 to 3 seconds, cool mottled skin, narrow pulse pressure, falling urine output, normal BP. The **Pediatric Assessment Triangle** (appearance, work of breathing, circulation to skin) takes under 30 seconds; act on the PEWS. Pain tools: FLACC from 2 months to 7 years, faces from 3, numeric from 7 or 8. First actions: a febrile infant 28 days or

younger with 38.0 °C rectal is escalated for sepsis; respiratory distress gets positioning and oxygen; shock gets access and a 20 mL/kg bolus. **Bradycardia after tachycardia is pre-arrest.**



No single pediatric normal. Heart and breathing rates fall as children grow, so a value is only normal or abnormal for an age band. A rising heart rate is the early warning; a falling pressure is late.

LOCK THESE IN

- The sequence of development is fixed; the rate is individual.
- Two major percentile lines crossed downward = growth faltering. Use corrected age for preterm growth, never for vaccines.
- Loss of an acquired skill is an urgent referral; check hearing first for language delay.
- No honey, cow's milk or juice before 12 months; vitamin D 400 IU for breastfed infants.
- Dose = mg/kg times weight, then the smaller of that and the adult maximum.
- 4-2-1 for maintenance; 20 mL/kg bolus for shock (10 mL/kg in special cases).
- Hypotension 1 to 10 years: under 70 + 2 × age.
- Tachycardia is early; hypotension and bradycardia are late.

Milestones at a glance

Age	Gross motor	Fine motor	Language and social
2 months	Lifts head prone	Hands fisted; follows to midline	Coos; social smile
4 months	Steady head; rolls front to back	Hands together; grasps rattle	Laughs; babbles
6 months	Tripod sits; rolls both ways	Transfers; ulnar rake	Consonant babble; stranger awareness
9 months	Sits alone; crawls; pulls to stand	Crude pincer	Mama/dada nonspecific; object permanence
12 months	Cruises; may walk	Neat pincer	1 to 3 words; waves
24 months	Kicks ball; stairs with rail	Stacks 6 cubes	50+ words; 2-word phrases
3 years	Pedals tricycle	Copies circle	3-word sentences; 75% intelligible
4 years	Hops on one foot	Copies cross	Fully intelligible; tells a story

Vital signs by age band (awake)

Age	Heart rate	Respiratory rate	Systolic BP
Neonate	100 to 205	30 to 60	60 to 90
Infant	100 to 180	30 to 53	72 to 104
Toddler	98 to 140	22 to 37	86 to 106
Preschool	80 to 120	20 to 28	89 to 112
School-age	75 to 118	18 to 25	97 to 115
Adolescent	60 to 100	12 to 20	110 to 131

Worked cases

WORKED CASE 1 · DOSE, VOLUME AND THE DAILY CEILING

A 16 kg child is ordered acetaminophen 15 mg/kg per dose. The suspension is 160 mg per 5 mL. Maximum is 75 mg/kg/day and five doses a day.

STEP 1 · DOSE

15 mg/kg × 16 kg = **240 mg**.

STEP 2 · VOLUME

240 ÷ 160 × 5 mL = **7.5 mL** by oral syringe.

STEP 3 · DAILY CHECK

75 × 16 = 1,200 mg a day. Five doses of 240 mg = 1,200 mg, exactly at the ceiling, so no sixth dose and no hidden acetaminophen in cold medicines.

STEP 4 · TEACH

Show the parent the 7.5 mL mark and have them draw it up; never a teaspoon.

WORKED CASE 2 · MAINTENANCE FLUID AND A BOLUS

A 32 kg child needs maintenance IV fluid. Later a 16 kg sibling in compensated shock needs a fluid bolus.

STEP 1 · 4-2-1 FOR 32 KG

First 10 kg: 40 mL/h. Next 10 kg: 20 mL/h. Remaining 12 kg: 12 mL/h.

STEP 2 · TOTAL

40 + 20 + 12 = **72 mL/h** of isotonic fluid.

STEP 3 · BOLUS FOR 16 KG

20 mL/kg × 16 kg = **320 mL** over 5 to 20 minutes.

STEP 4 · REASSESS

After each bolus check heart rate, refill, mental status, liver edge and breathing before giving another.

WORKED CASE 3 · IS THIS BLOOD PRESSURE LOW?

A 5-year-old with vomiting has a heart rate of 160, capillary refill of 4 seconds, mottled knees and a systolic BP of 84.

STEP 1 · THRESHOLD

For ages 1 to 10, hypotension is under 70 + (2 × age): 70 + 10 = **80 mm Hg**.

STEP 2 · COMPARE

84 is above 80, so the pressure is not yet low.

STEP 3 · READ THE REST

Heart rate 160 is above the preschool range of 80 to 120, refill is delayed and the skin is mottled: compensated shock.

STEP 4 · ACT

Access and a 20 mL/kg bolus now, glucose check, and SBAR escalation. Do not wait for the pressure to fall.

WORKED CASE 4 · HOW DEHYDRATED IS THIS TODDLER?

A toddler weighed 12.0 kg at a clinic visit last week and weighs 11.1 kg today after two days of diarrhea.

STEP 1 · WEIGHT LOST

12.0 minus 11.1 = 0.9 kg, which is about 900 mL of fluid deficit.

STEP 2 · PERCENT

0.9 ÷ 12.0 × 100 = **7.5 percent**.

STEP 3 · GRADE

5 to 10 percent is moderate dehydration.

STEP 4 · PLAN

ORS about 100 mL/kg over 4 hours in small frequent sips, plus about 10 mL/kg per extra loose stool, and watch urine output.

TRAPS PEOPLE FALL INTO

- **Plotting a former preterm infant by chronological age.** Use corrected age for growth and development until about 2 to 3 years.
- **Delaying vaccines for prematurity or a cold.** Vaccinate by chronological age at full dose; mild illness is not a contraindication.
- **"Watch and wait" for a lost skill.** Regression at any age is an urgent referral.
- **Trusting a normal blood pressure in a tachycardic, mottled child.** That is compensated shock; hypotension comes late.
- **Skipping the adult ceiling for a big adolescent.** The dose is the smaller of the weight-based dose and the adult maximum.
- **Teaching a liquid dose in teaspoons.** Use an oral syringe marked in milliliters.

Chapter 11 self-test · ten items

1. A 14-month-old has eight teeth. Using the rule of thumb, is this expected?

A. No, there should be all 20 by now
B. No, the first tooth comes at 18 months
C. Yes, but only if all are molars
D. Yes, 14 minus 6 gives about 8 teeth

D. Yes, 14 minus 6 gives about 8 teeth Up to about 2 years, teeth roughly equal age in months minus 6.

2. A child tracked the 75th percentile for weight and is now at the 25th. What does this suggest?

A. Normal catch-down to the parents' size
B. Expected toddler physiologic anorexia
C. Growth faltering that needs assessment
D. A charting error to ignore

C. Growth faltering that needs assessment Sustained downward crossing of two major percentile lines is growth faltering.

3. A preschooler asks if the illness is because they were naughty. Which response fits Erikson's stage?

A. "Germs only get naughty children."
B. "Nothing you did made you sick."
C. "You need to be good from now on."
D. "Let's talk about it when you're older."

B. "Nothing you did made you sick." Preschoolers may see illness as punishment; say plainly it is not their fault.

4. Which finding at a 9-month visit needs a referral?

A. No babbling and does not sit alone
B. Says "dada" to everyone
C. Separation protest when the parent leaves
D. Uses a crude pincer grasp

A. No babbling and does not sit alone Not sitting by 9 months and no babbling are red flags.

5. Which food is safe to offer a 10-month-old?

A. A spoonful of honey
B. Iron-fortified infant cereal
C. Whole grapes as finger food
D. A cup of whole cow's milk

B. Iron-fortified infant cereal Iron-rich foods come first; honey and cow's milk wait until 12 months, and grapes are quartered.

6. A 4-month-old born at 28 weeks is due for vaccines. What is correct?

A. Skip all live vaccines until age 2
B. Give half doses because of size
C. Give the 4-month vaccines at full dose
D. Wait until a corrected age of 4 months

C. Give the 4-month vaccines at full dose Vaccines follow chronological age at full dose; corrected age is for growth.

7. Which injury pattern should raise a safeguarding concern?

A. Bruises on the torso of a 3-month-old
B. A bruised shin on an active 3-year-old
C. A forehead bump on a 14-month-old
D. A scraped knee on a new walker

A. Bruises on the torso of a 3-month-old Pre-mobile infants do not bruise themselves; bruising is a sentinel injury.

8. A 22 kg child needs maintenance fluid. What is the hourly rate by 4-2-1?

A. 44 mL/h
B. 66 mL/h
C. 88 mL/h
D. 62 mL/h

D. 62 mL/h 40 for the first 10 kg, 20 for the next 10, plus 2 for the last 2 kg: 62 mL/h.

9. Which sign appears earliest in pediatric shock?

A. Absent central pulses
B. Tachycardia
C. Hypotension
D. Bradycardia

B. Tachycardia Children compensate with heart rate first; hypotension is late.

10. Parents bring in their 19-day-old, who feels warm but is feeding. The rectal reading is 38.1 °C. What does the nurse do first?

A. Unbundle and recheck in 30 minutes
B. Give acetaminophen and recheck in an hour
C. Advise the family to watch overnight
D. Escalate now for a full sepsis evaluation

D. Escalate now for a full sepsis evaluation A febrile infant 28 days or younger needs urgent sepsis workup and antibiotics.

CHAPTER 12

Pediatric Respiratory and Cardiovascular Conditions

Read it in full: **Chapter 12 in the textbook**. Practice it in the lab: **Croup, Epiglottitis and the Choking Child: Build the Picture, Then Choose the First Action** and **The Congenital Heart Map: Shunts, Obstruction, the Duct and the Tet Spell**.

What to know

Airway resistance rises with the **fourth power** of a shrinking radius. An infant trachea has a radius of about 2 mm; 1 mm of edema halves it, removes about three quarters of the area and raises resistance about **sixteen fold**. The infant chest wall is soft, so retractions come early; ribs are horizontal, so minute ventilation rises by rate; the diaphragm tires. Oxygen use is high and reserve small, so desaturation after apnea takes seconds. Stroke volume is fairly fixed, so **cardiac output depends on heart rate**: tachycardia is the first alarm and **bradycardia is pre-arrest**.

Read vitals by age band; fever adds about 10 beats per minute per degree Celsius. Blood pressure is the last to fail; when it drops, 30 to 40 percent of volume may be gone. Hypotension: under 60 (neonate), under 70 (infant), under 70 + 2 × age (1 to 10 years), under 90 (over 10). Urine output: 1.5 to 2 mL/kg/h in infants and toddlers, at least 1 in older children, at least 0.5 in adolescents; weigh diapers. Dose by kg, check the adult maximum; 4-2-1 for maintenance; 20 mL/kg boluses for shock (10 mL/kg for neonates, cardiac disease, malnutrition and DKA).

Start at the doorway with appearance, work of breathing and circulation to skin. **Grunting** means alveolar disease. A child who stops fighting the mask has usually not improved. Escalate for stridor at rest, grunting, head bobbing, a silent chest, a falling rate with rising effort, SpO2 under 90 on oxygen, apnea in an infant under 2 months, refill over 3 seconds, heart rate under 60 with poor perfusion, or a parent saying the child is not themselves.

Croup (parainfluenza, 6 months to 3 years): barking cough, inspiratory stridor and hoarseness after a few days of cold symptoms, worse at night. Keep the child calm on the caregiver's lap; no X-rays to diagnose. **Every severity gets dexamethasone 0.6 mg/kg** (usual maximum 16 mg); stridor at rest adds nebulized epinephrine, then 3 to 4 hours of observation for rebound. Humidified air has no proven benefit. Softer stridor with more drowsiness means less air moving.

Epiglottitis (abrupt, 2 to 7 years, often under-immunized): toxic, high fever, tripod position, drooling, dysphagia, muffled voice, no barking cough. **Do not inspect the throat, use a tongue depressor, lay the child down, start an IV or leave the child.** Keep upright on the caregiver's lap, nil by mouth, blow-by oxygen only if tolerated, and call the airway team for intubation in the operating room. Antibiotics follow airway control. Bacterial tracheitis is croup that fails epinephrine, with high fever and thick secretions.

Foreign body aspiration peaks at 1 to 3 years: sudden choking, then cough and one-sided wheeze. If the child coughs, speaks or cries, let them cough. If not: infant under 1 year, five back blows and five chest thrusts; child over 1, abdominal thrusts; never blind finger sweeps. A swallowed button battery is an emergency. Pediatric sleep apnea is usually from big tonsils and adenoids. After tonsillectomy, **frequent swallowing**, throat clearing and a rising pulse are early bleeding signs; no straws or red fluids; bleeding risk peaks in the first 24 hours and again at 7 to 10 days.

Bronchiolitis (mostly RSV, infants): plugs in tiny airways, air trapping, wheeze and crackles; worst on days 3 to 5. Poor feeding is a respiratory sign; infants under 2 months may present with apnea. Treatment is **suction, hydration, upright position and oxygen if persistently under 90 percent**; high-flow for rising work. Not recommended: routine bronchodilators, steroids, antibiotics or chest physiotherapy. Contact and droplet precautions. High-risk infants get palivizumab or nirsevimab, which are antibodies, not vaccines.

Asthma has three parts: bronchospasm, edema and mucus. Only bronchospasm reverses in minutes, which is why **steroids go in early**. Peak flow: green 80 percent or more of personal best, yellow 50 to 79, red under 50. A normalizing or rising $PaCO_2$ in a child still working hard, a silent chest or inability to speak in sentences means impending failure. Treatment: oxygen to 92 percent or more, albuterol (2.5 mg under 20 kg, 5 mg at 20 kg or more, or 0.15 mg/kg with a 2.5 mg minimum) every 20 minutes for three doses, ipratropium in the first hour for moderate to severe, prednisolone 1 to 2 mg/kg/day (maximum 60 mg) and IV magnesium for severe attacks. A spacer works as well as a nebulizer for mild to moderate attacks. Rinse after inhaled steroids.

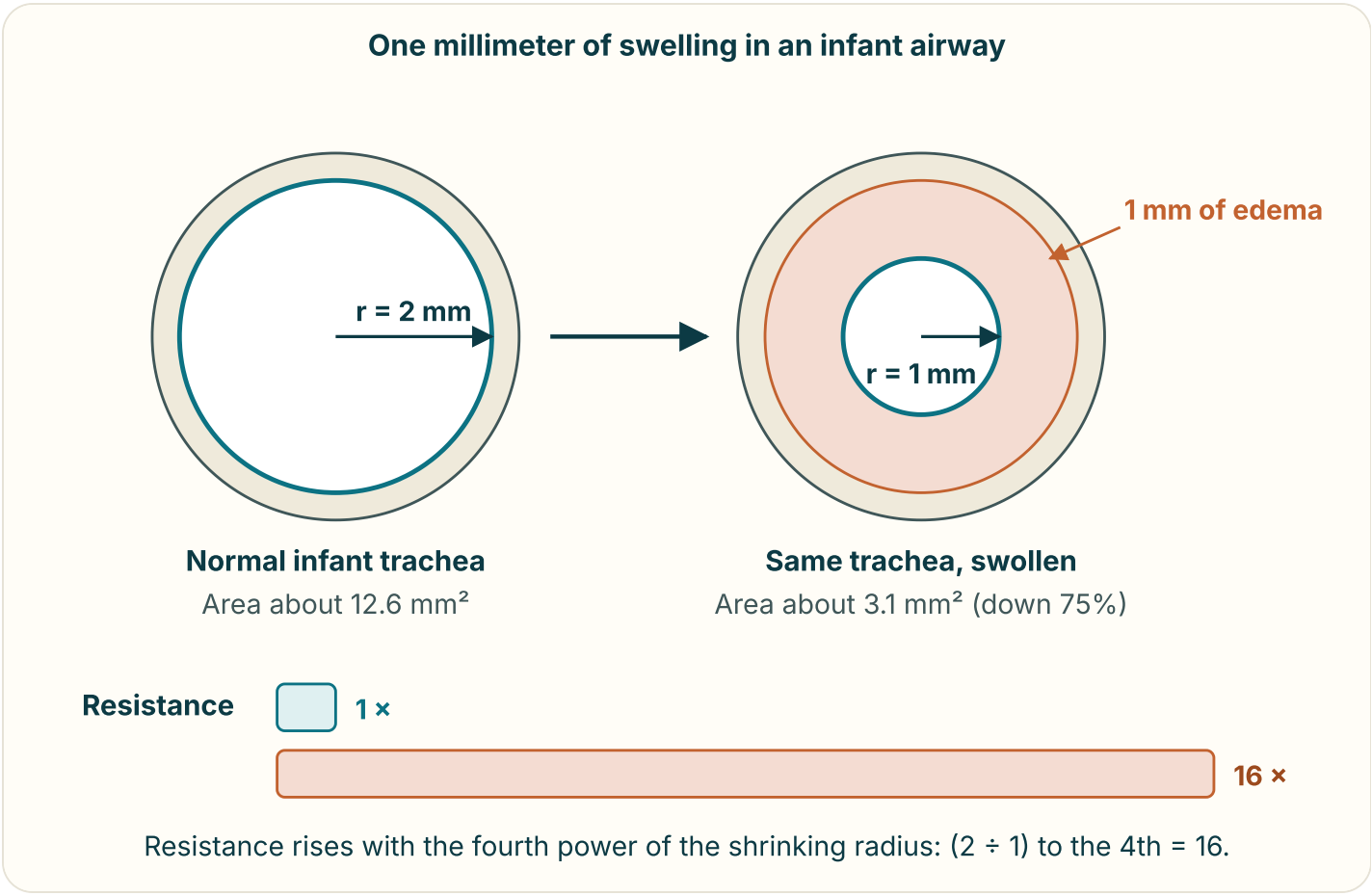
Pneumonia: mostly viral under 5; pneumococcus is the common bacterial cause; Mycoplasma causes "walking pneumonia" over 5. **Tachypnea is the most sensitive sign.** Lower-lobe pneumonia can present as belly pain. High-dose amoxicillin 90 mg/kg/day divided every 12 hours (maximum 4 g). Fever beyond 48 to 72 hours on antibiotics suggests effusion or empyema. **Cystic fibrosis** (autosomal recessive CFTR): thick secretions, chronic infection, pancreatic insufficiency, salty skin, meconium ileus. Sweat chloride 60 mmol/L or more is diagnostic. Airway clearance before meals, enzymes with every meal and snack (never crushed), high-calorie diet with added salt and vitamins A, D, E and K.

At birth falling lung resistance closes the foramen ovale and the duct. Left-to-right shunts are often silent until 4 to 8 weeks; ductal-dependent lesions collapse on day 2 or 3. CCHD screening at 24 to 48 hours: pass at 95 percent or more with a difference of 3 or less; under 90 fails. **Prostaglandin E1** keeps the duct open: watch for apnea, hypotension and fever; never interrupt or bolus it. **Increased flow lesions** (VSD with a harsh holosystolic murmur, ASD with a fixed split S2, PDA with a machinery murmur, AVSD with trisomy 21) cause tachypnea, sweating with feeds and poor gain; untreated, Eisenmenger syndrome reverses the shunt. **Coarctation**: strong arm pulses, weak femoral pulses, arm-to-leg pressure gap.

Cyanotic lesions include the five Ts and hypoplastic left heart; cyanosis shows when about 5 g/dL of hemoglobin is desaturated, and polycythemia raises stroke risk, so keep cyanotic children hydrated. A **tet spell** is more blood crossing right to left. The first step is the **knee-chest position**, then calm the child, then 100 percent oxygen, morphine 0.1 mg/kg, an IV bolus and phenylephrine

or a beta-blocker. Oxygen alone will not break it. Infant heart failure shows first in feeding: feeds over 30 minutes, sweating, tachypnea and a flat weight, with hepatomegaly rather than neck veins.

Kawasaki disease: fever 5 days or more plus four of five features (conjunctival injection without discharge, red cracked lips or strawberry tongue, rash, hand and foot changes then peeling, one large neck node), with marked irritability. The risk is **coronary aneurysm**. IVIG 2 g/kg within 10 days plus aspirin; defer live vaccines 11 months after IVIG. **Rheumatic fever** follows untreated strep throat; carditis scars the mitral valve; secondary prophylaxis with benzathine penicillin every 4 weeks. **Digoxin**: count the apical pulse a full minute; hold if under 90 to 110 (infant), under 70 (child) or under 60 (adolescent); low potassium raises toxicity; early toxicity is vomiting, poor feeding and bradycardia. **SVT** (over 220 infant, over 180 child, fixed rate, no P waves): vagal maneuvers first (ice to the face in infants), then adenosine 0.1 mg/kg rapid push with a flush (max 6 mg), then 0.2 mg/kg (max 12 mg); unstable means synchronized cardioversion at 0.5 to 1 J/kg. Pediatric arrest is usually respiratory: oxygenate first; **compress for a heart rate under 60 with poor perfusion**; 30:2 single rescuer, 15:2 for two; epinephrine 0.01 mg/kg (max 1 mg); defibrillate 2 then 4 J/kg.



Small swelling, big resistance. Halving the radius cuts the area to a quarter and raises resistance sixteen fold. That is why croup gives a toddler stridor at rest while the same swelling only makes an adult hoarse.

LOCK THESE IN

- Half the radius, sixteen times the resistance.
- Croup: calm child, dexamethasone 0.6 mg/kg. Epiglottitis: hands off the throat, call the airway team.
- Bronchiolitis: suction, hydration, oxygen; no routine bronchodilators or steroids.
- Asthma: early systemic steroid; a silent chest or rising PaCO2 means failure.
- Tachypnea is the most sensitive sign of pneumonia.
- Tet spell: knee-chest first, then calm, oxygen, morphine, fluid.
- Kawasaki: IVIG 2 g/kg within 10 days to protect the coronaries.
- Compress at a heart rate under 60 with poor perfusion; arrest is usually respiratory.

Croup versus epiglottitis

Feature	Croup	Epiglottitis
Onset	Gradual, after 1 to 3 days of cold symptoms	Abrupt, over hours
Age	6 months to 3 years	2 to 7 years
Cough	Barking, seal-like	Absent
Voice	Hoarse	Muffled, minimal speech
Drooling	No	Yes
Fever	Low grade	High, toxic
Posture	Comfortable upright	Tripod, chin forward
First action	Calm; dexamethasone 0.6 mg/kg	Do not touch the throat; airway team

Congenital heart lesions

Lesion	Physiology	Hallmark	Priority
VSD	Left-to-right shunt	Harsh holosystolic murmur, LLSB	Calories, diuretics; patch if large
ASD	Left-to-right shunt	Fixed split S2	Device or surgical closure
PDA	Left-to-right shunt	Machinery murmur, bounding pulses	Indomethacin or ibuprofen in preterm
Coarctation	Systemic obstruction	Arm-to-leg BP gap, weak femorals	PGE1 if ductal-dependent; repair
Tetralogy of Fallot	Right-to-left shunt	Tet spells, boot-shaped heart	Knee-chest in a spell; repair in infancy
Transposition	Parallel circulations	Profound cyanosis within hours	PGE1, septostomy, arterial switch
Hypoplastic left heart	Ductal-dependent systemic flow	Gray, shocked as the duct closes	PGE1; staged surgery

Worked cases

WORKED CASE 1 · CROUP BY THE KILOGRAM

A 12 kg toddler has a barking cough and stridor at rest with mild retractions. Dexamethasone 0.6 mg/kg is ordered, usual maximum 16 mg.

STEP 1 · GRADE IT

Stridor at rest with retractions and an interactive child: moderate croup.

STEP 2 · DOSE

0.6 mg/kg × 12 kg = **7.2 mg**, under the 16 mg maximum, so 7.2 mg is given.

STEP 3 · ADD EPINEPHRINE

Stridor at rest adds nebulized epinephrine, which acts within 10 to 30 minutes.

STEP 4 · OBSERVE

Watch 3 to 4 hours for rebound obstruction before discharge, with the child calm on the caregiver's lap.

WORKED CASE 2 · THE STEROID CEILING IN A LARGE ADOLESCENT

A 38 kg adolescent with severe asthma is ordered prednisolone 2 mg/kg/day. The maximum is 60 mg a day.

STEP 1 · MULTIPLY

2 mg/kg × 38 kg = **76 mg**.

STEP 2 · COMPARE

76 mg exceeds the 60 mg daily maximum.

STEP 3 · GIVE

60 mg, and document and communicate the difference.

STEP 4 · ADD THE REST

Oxygen to 92 percent or more, albuterol, ipratropium in the first hour, and magnesium for a severe attack: 50 mg/kg would be 1,900 mg, under the 2 g cap.

WORKED CASE 3 · SVT IN A 7 KG INFANT

An infant has a fixed heart rate of 260, no visible P waves, pallor and poor feeding but a normal blood pressure and alert state.

STEP 1 · NAME IT

A fixed rate over 220 with no P waves that does not change with comfort: SVT. The infant is stable.

STEP 2 · FIRST

Vagal maneuver: a bag of iced water on the forehead and nose bridge for 15 to 30 seconds. Never ocular pressure or carotid massage.

STEP 3 · ADENOSINE

0.1 mg/kg × 7 kg = **0.7 mg** by rapid push with an immediate saline flush through a proximal line; second dose 0.2 mg/kg = 1.4 mg.

STEP 4 · IF UNSTABLE

Synchronized cardioversion at 0.5 to 1 J/kg, escalating to 2 J/kg.

WORKED CASE 4 · ARREST DOSES FOR A 20 KG CHILD

A 20 kg child becomes pulseless after a long respiratory illness. A length tape confirms the weight.

STEP 1 · PRIORITY

Pediatric arrest is usually respiratory: ventilate and oxygenate with high-quality compressions, 15:2 with two rescuers.

STEP 2 · EPINEPHRINE

0.01 mg/kg × 20 kg = **0.2 mg**, which is 2 mL of the 0.1 mg/mL concentration, every 3 to 5 minutes.

STEP 3 · IF SHOCKABLE

2 J/kg × 20 = **40 J**, then 4 J/kg = 80 J.

STEP 4 · FAMILY

Assign a staff member to support family members who wish to be present.

TRAPS PEOPLE FALL INTO

- **Looking in the throat of a drooling, tripod-positioned child.** Suspected epiglottitis: nothing in the mouth, no lying down, no IV until the airway team is there.
- **Calling softer stridor or a silent chest an improvement.** Less noise can mean less air moving.
- **Giving albuterol and steroids for bronchiolitis.** Supportive care only: suction, hydration, oxygen.
- **Reaching for oxygen first in a tet spell.** Knee-chest first; the problem is shunt direction, not gas exchange.
- **Giving MMR soon after IVIG for Kawasaki disease.** Defer live vaccines 11 months after IVIG.
- **Waiting for pulselessness to start compressions.** Start for a heart rate under 60 with poor perfusion despite good ventilation.

Chapter 12 self-test · ten items

1. One millimeter of edema halves an infant's tracheal radius. About how much does resistance rise?

A. About 8 times

B. About 4 times

C. About 2 times

D. About 16 times

D. About 16 times Resistance varies with the fourth power of the radius: 2 to the fourth is 16.

2. What is the hypotension threshold for a 6-year-old?

A. Systolic under 90 mm Hg
B. Systolic under 82 mm Hg
C. Systolic under 60 mm Hg
D. Systolic under 70 mm Hg

B. Systolic under 82 mm Hg For ages 1 to 10 it is 70 plus twice the age: 70 + 12 = 82.

3. A 2-year-old has a barking cough at night with no stridor at rest. What treatment fits?

A. A neck X-ray to confirm the diagnosis
B. Antibiotics for bacterial croup
C. Oral dexamethasone 0.6 mg/kg
D. Nebulized epinephrine and admit

C. Oral dexamethasone 0.6 mg/kg Every severity of croup receives dexamethasone; epinephrine is for stridor at rest.

4. A 4-year-old sits forward, drools and speaks in a muffled voice with a high fever. What does the nurse do?

A. Keep her upright on her parent's lap; call airway team
B. Look at her throat using a tongue depressor
C. Lay her flat on the stretcher to start an IV
D. Obtain a throat swab for culture before anything

A. Keep her upright on her parent's lap; call airway team Suspected epiglottitis: any instrument or supine position can trigger complete obstruction.

5. Which therapy is recommended for a 3-month-old with RSV bronchiolitis?

A. Chest physiotherapy twice daily
B. Oral prednisolone for 3 days
C. Nasal suction before feeds
D. Nebulized albuterol every 4 hours

C. Nasal suction before feeds Bronchiolitis care is supportive: suction, hydration and oxygen as needed.

6. During an asthma attack a child's PaCO2 rises from 30 to 44 while the work of breathing stays high. What does this mean?

A. Recovery as the attack begins to settle
B. Tiring, with impending respiratory failure
C. A normal blood gas, so no action needed
D. An expected effect of repeated albuterol

B. Tiring, with impending respiratory failure Early attacks lower CO2; a normalizing or rising value in a working child signals failure.

7. Which is the most sensitive sign of pneumonia in a child?

A. A high fever
B. A productive cough
C. Crackles on auscultation
D. A fast breathing rate

D. A fast breathing rate Tachypnea is more sensitive than auscultation in children.

8. A toddler with tetralogy of Fallot becomes deeply cyanotic and hyperpneic after crying. What is first?

A. Place in the knee-chest position
B. Give 100% oxygen by face mask
C. Start an IV fluid bolus now
D. Give IV morphine 0.1 mg/kg

A. Place in the knee-chest position Knee-chest raises systemic resistance and pushes blood to the lungs; the rest follows.

9. A child has had fever for 6 days with red lips, conjunctival injection and swollen hands. What complication is the priority to prevent?

A. Mitral valve scarring
B. Acute kidney injury
C. Coronary artery aneurysm
D. Bacterial pneumonia later

C. Coronary artery aneurysm Kawasaki disease threatens the coronary arteries; IVIG within 10 days lowers the risk.

10. Before giving digoxin to an infant, the apical pulse is 84. What should the nurse do?

A. Hold the dose and notify the prescriber
B. Give it mixed into a bottle of formula
C. Give half the dose instead
D. Give the dose and recheck in an hour

A. Hold the dose and notify the prescriber Hold for an apical rate under 90 to 110 in an infant.

Cram sheet

Everything from chapters 11 and 12 in one place. Cover the right column and see if you can rebuild each row.

Growth, development and safety numbers

Item	Value	Note
Birth weight	Doubles 4 to 6 mo; triples 12 mo; quadruples 24 mo	Length up 50% in year one
Fontanelles	Posterior 2 to 3 mo; anterior 12 to 18 mo	Assess calm and upright
Teeth	Age in months minus 6	20 primary teeth by 30 months
Vitamin D	400 IU a day	Breastfed infants
Weight estimate	(Age × 2) + 8 kg	Ages 1 to 5, emergencies only
4-2-1	4, 2, 1 mL/kg/h by weight band	Isotonic fluid
Bolus	20 mL/kg; 10 mL/kg special cases	Reassess after each
Hypotension 1 to 10 y	70 + 2 × age	Late sign

Respiratory and cardiac rules

Condition	First action	Never
Croup	Calm; dexamethasone 0.6 mg/kg	Upset the child for tests
Epiglottitis	Upright; airway team	Tongue depressor or supine
Choking infant	5 back blows, 5 chest thrusts	Blind finger sweep
Bronchiolitis	Suction, hydrate, oxygen	Routine bronchodilators
Asthma	Oxygen, albuterol, early steroid	Trust a silent chest
Tet spell	Knee-chest	Oxygen alone
SVT stable	Ice to the face, then adenosine	Carotid massage
Bradycardia under 60, poor perfusion	Compressions after good ventilation	Wait for pulselessness

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