Tiny Patients, High Stakes:

Neonatal Essentials for Emergency Medicine

28 April 2026

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Disclosures

- I have no financial disclosures to make

- Many medications discussed in this presentation are used off-label in neonates (87-96% of NICU patients receive at least one off-label medication). Off-label use is neither improper nor investigational when based on sound scientific evidence, expert judgment, and published literature, and reflects standard neonatal practice.

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Land Acknowledgement

I acknowledge the original inhabitants and traditional village sites of the land now occupied by Portland, including the Multnomah, Kathlamet, Clackamas, Tumwater, and Watlala bands of the Chinook; the Tualatin Kalapuya; the Molalla; and the Wasco, among many Indigenous nations of the Willamette Valley and Columbia River Plateau.

I also recognize the enduring presence and sovereignty of the Tribal Nations connected to these lands today, including the Confederated Tribes of Grand Ronde, Confederated Tribes of Siletz Indians, Confederated Tribes of Warm Springs, Confederated Tribes of the Umatilla Indian Reservation, and the Cowlitz Indian Tribe.

I take this opportunity to thank the original caretakers of this land - past, present, and future.

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Learning Objectives

By the end of this session, participants will be able to:

1. Apply the core principles of neonatal resuscitation (NRP) in emergency settings where subspecialty support may be unavailable
2. Navigate neonatal airway challenges using a structured approach
3. Recognize and initiate management of time-sensitive neonatal emergencies across key organ systems
4. Identify common pitfalls and high-yield pearls in neonatal resuscitation

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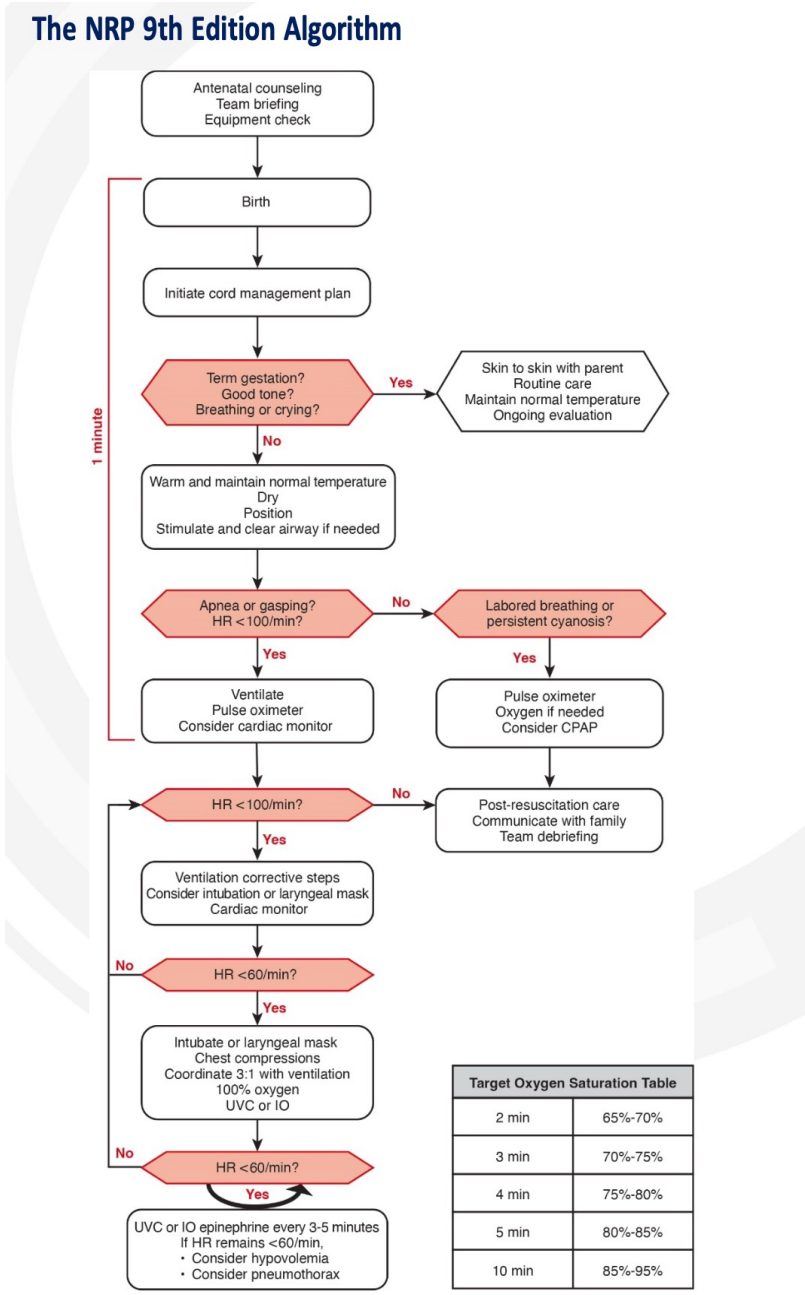
NRP Review – The Basics

- New edition every ~5 years
- NRP 9th Edition released Fall 2025
- Key differences:
  - Initial PIP set to 25 cm H2O
  - Time extended to 15-30sec before beginning initial corrective steps of ventilation
  - Perform corrective steps of ventilation in the order most likely to be helpful
  - A laryngeal mask may now be used as a primary device for ventilation (previously a rescue airway)
  - ETT size and securing



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NRP Review

- Key differences from PALS
  - Focus: Transition from intrauterine to extrauterine life
  - Primary intervention: Ventilation
  - Heart rate assessment: Auscultation preferred initially, ECG for rapid/accurate measurement
  - Initial steps: Warm, dry, stimulate
- When to ventilate
  - Gasping or apneic after birth
  - HR <100 bpm despite initial steps

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NRP Review – Chest Compressions

- **When:** HR <60 despite an advanced airway (ETT or LMA) and 30 seconds of adequate ventilation (chest rise)
- **Ratio:** 3 compressions : 1 breath **(synchronized)**
- **Rate:** 90 compressions : 30 breaths per minute = 120 events/min
- Turn O2 up to 100%
- Ensure cardiac monitor leads in place
- Thumbs with encircling hands preferred
  - Depth of 1/3 AP diameter
  - Lower 1/3 sternum above xiphoid process

American Academy of Pediatrics 2025

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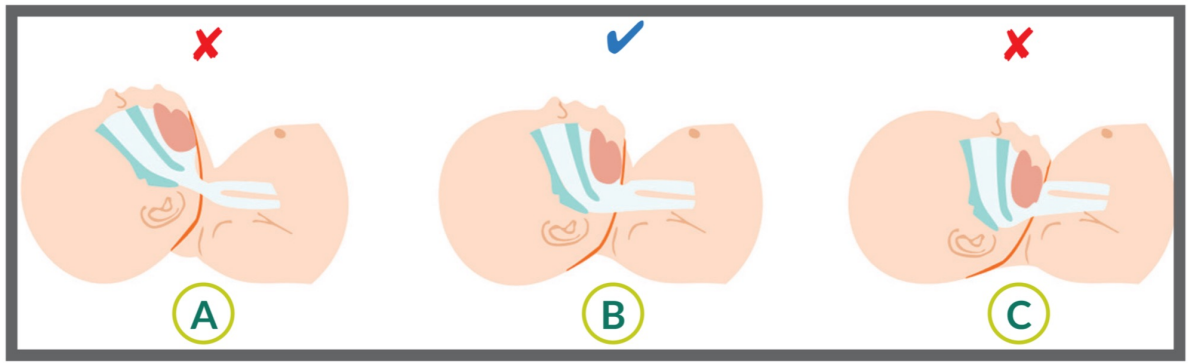
Corrective Steps for Ventilation

- **M**ask
- **R**eposition
- **S**uction
- **O**pen mouth
- **P**ressure
- **A**dvanced airway



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The first sign of effective ventilation is an increasing heart rate

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NRP vs PALS?

Insufficient evidence to give a definite answer

Instead, consider etiology

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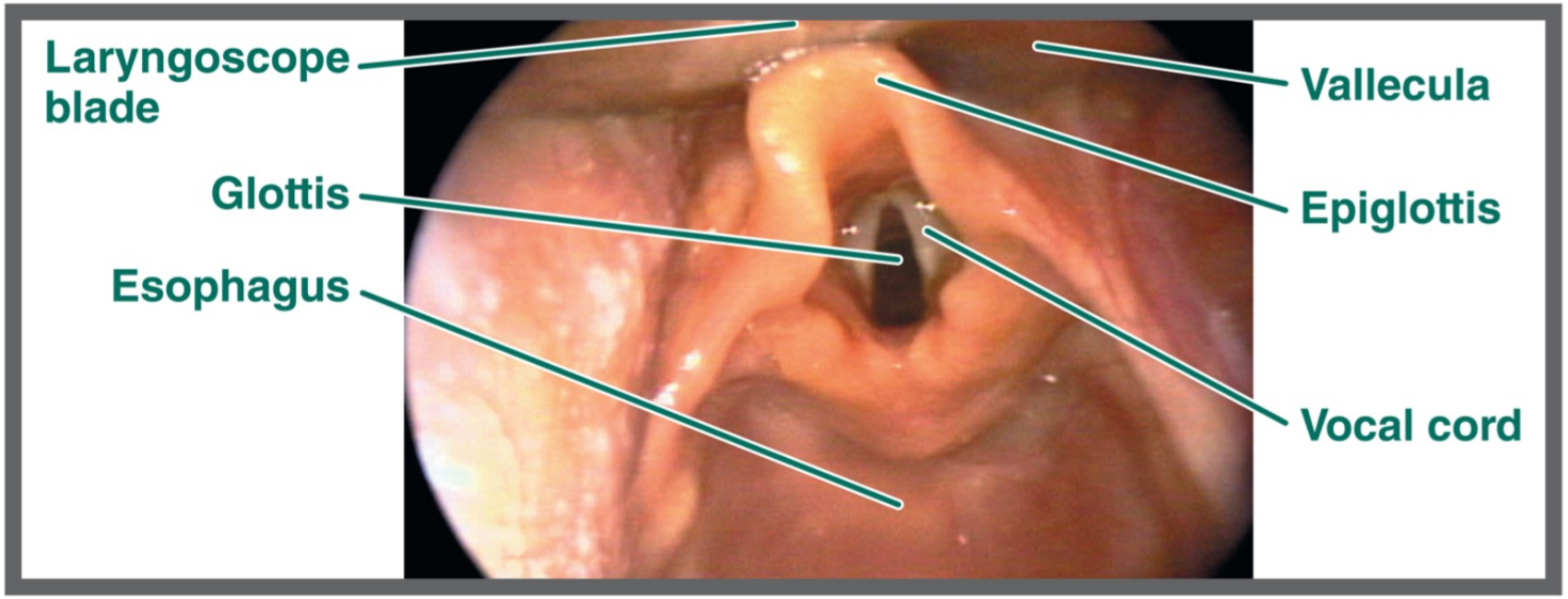
Neonatal Airway



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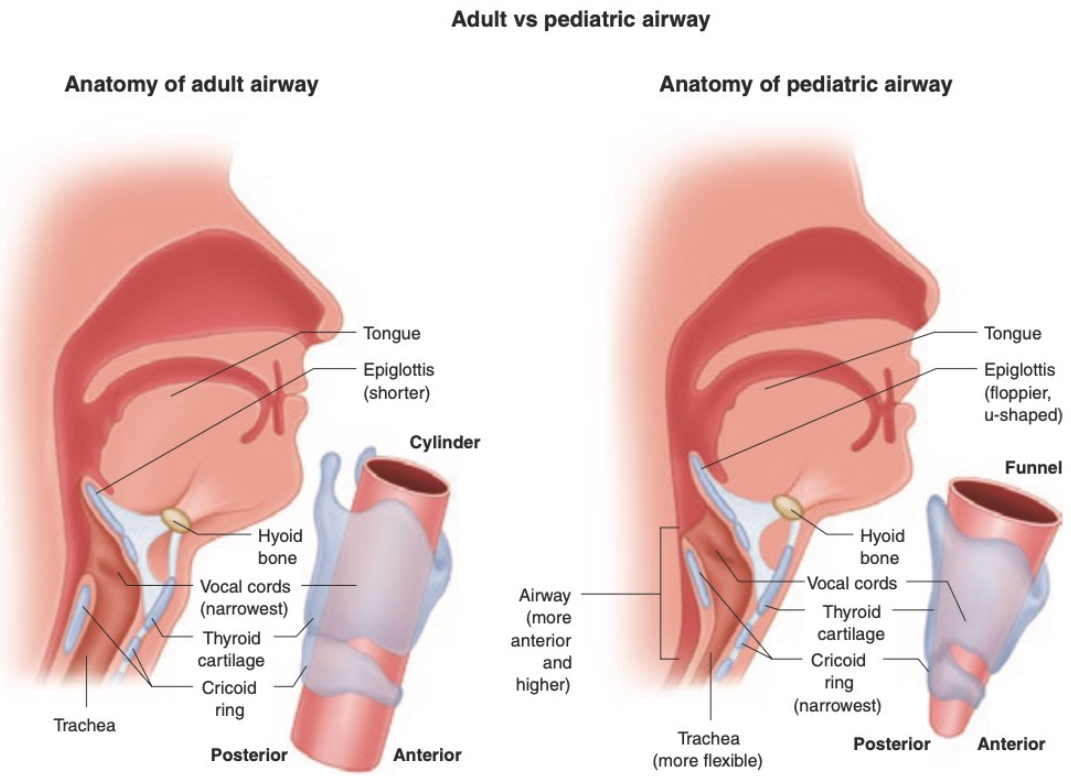
Airway: Anatomical Differences

- Anterior airway
- Large occiput
- Larger tongue, epiglottis, arytenoids relative to airway size
- Funnel-shaped larynx with cricoid at narrowest point
- Obligate nose breathers
- May desaturate more quickly
  - Higher O2 consumption
  - Limited pulmonary reserve



ETT vs. LMA?

Choose an ETT if:

- Anticipate chest compressions
- Personnel and equipment allow

Choose an LMA if:

- Advanced airway is needed but intubation is not feasible or not successful

-AND-

- Is not extremely preterm
  - Size 0 for "<2kg" however not all brands or centers have this equipment

Recall you can also use adjuncts like nasal trumpet or oropharyngeal airway to support as needed before this step

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Switching gears:
The ill-appearing neonate

Time-sensitive emergencies

Get a gas with a lactate!

Time-Sensitive Emergencies

Any sick neonate needs:	***High lactate + metabolic acidosis:***
• **Blood gas** • **Lactate** • **Glucose** • **Ammonia**	Sepsis/shock Cardiac (ductal-dependent lesion) Metabolic (organic acidemia) Hypoxic-ischemic injury

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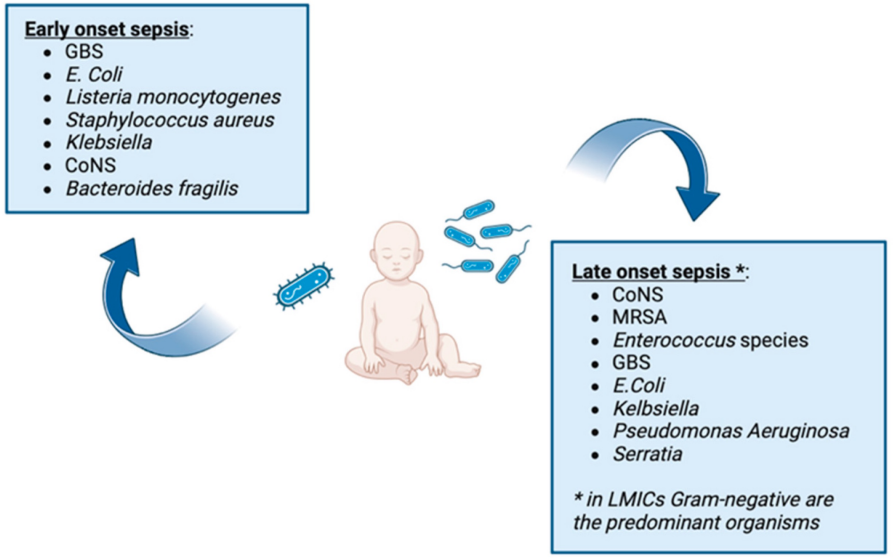
Infection: Early Antibiotics Save Lives

Presentation

- Nonspecific!
  - Temperature instability
  - Poor feeding
  - Lethargy
  - Respiratory distress
  - Tachycardia OR bradycardia
- Late signs:
  - Hypotension
  - Metabolic acidosis
  - Poor perfusion
  - Shock
- Also consider:
  - Apnea
  - Seizure

ED Management

- Antibiotics as soon as possible
- Blood and urine culture +/- CSF
- Standard antibiotic choices:
  - Ampicillin and gentamicin
  - Consider 3rd generation cephalosporin if CNS concerns
- HSV studies and acyclovir?



Boscarino et al, 2024

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Dehydration in Neonates

High-risk period: first two weeks of life (especially breastfed infants)

Presentation

- Weight loss >10% from birth
- Decreased urine output, lethargy
- Hypernatremia
- Sunken fontanelle, poor skin turgor

ED Management

- Careful fluid resuscitation
- Correct sodium slowly
- Address feeding issues
- Monitor glucose
- Monitor bilirubin

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Dehydration in Neonates

High-risk period *infants)*

Presentation

- Weight loss > scitation
- Decreased u lowly lethargy
- Hypernatrem
- Sunken fonta ssues turgor

"Walk me through the process of how you are mixing your bottles"

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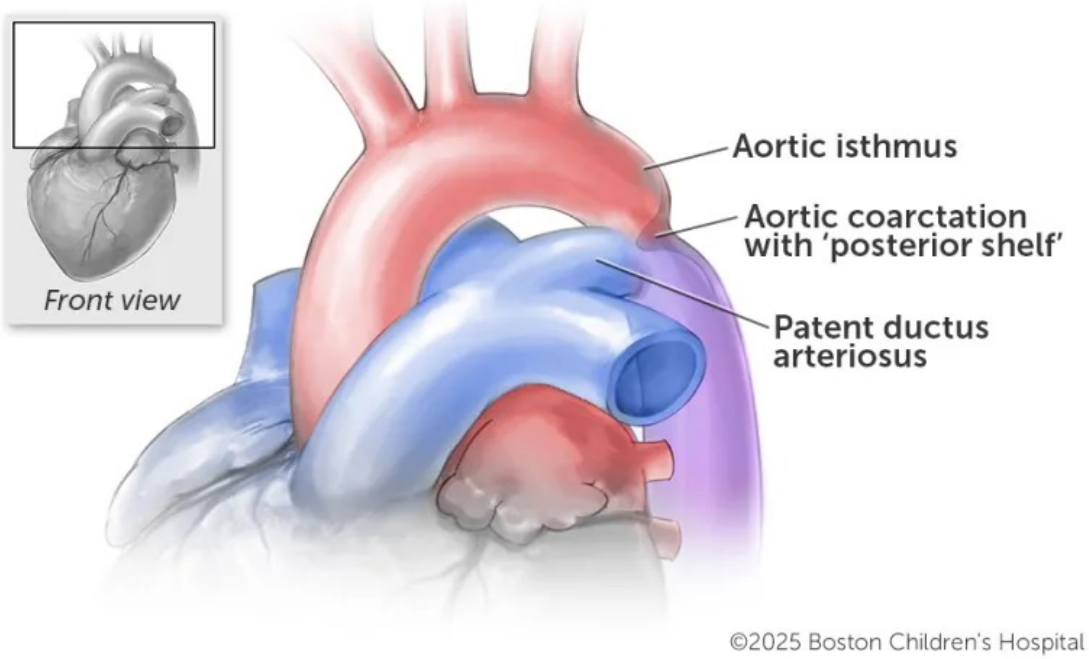
Cardiac Emergency: Coarctation of the Aorta

Presentation

- Ductus arteriosus closes* between day 1-7 of life
- Severe LV dysfunction, cardiogenic shock
- Differential BP and pulses (upper > lower)
- Metabolic acidosis, poor perfusion, abdominal hypoperfusion



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ED Management

- Prostaglandin E1 (PGE1) - CRITICAL to reopen ductus
- Echocardiography
- NPO + fluids
- May require intubation/inotropes
- Thoughtful fluid resuscitation in case of LV dysfunction
- Urgent cardiology consultation

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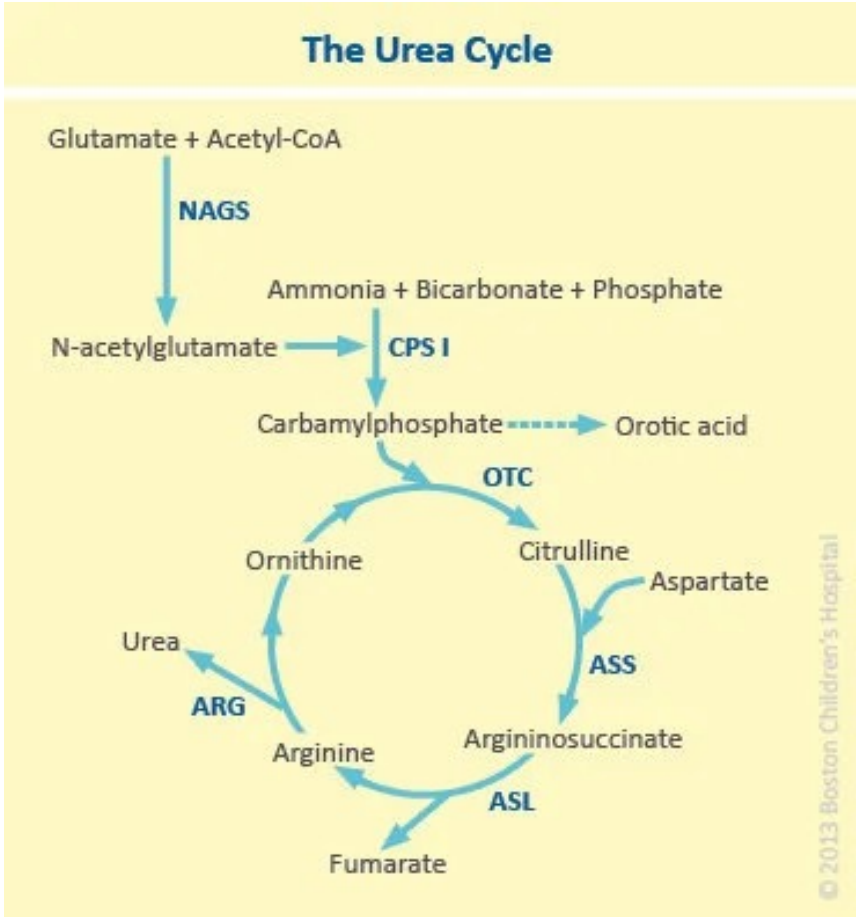
Metabolic Emergency: Hyperammonemia

Urea cycle disorders

- Not touching on other IEM's
  - Organic acidemias
  - Disorders of fatty acid oxidation
- Protein breakdown produces ammonia
- Urea cycle converts ammonia to urea for excretion
- Mostly autosomal recessive, except for OTC deficiency (X-linked)



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Metabolic Emergency: Hyperammonemia

Urea cycle disorders: Ornithine Transcarbamylase (OTC) Deficiency

Presentation

- May present day 2-10 of life after feeds initiated (protein intake)
- Symptoms
  - Encephalopathy, lethargy, hypotonia
  - Vomiting/poor feeding
  - Hypothermia
  - Potential seizures
- Labs:
  - Hyperammonemia (often >200 umol/L)
  - Respiratory alkalosis or mixed alkalosis-acidosis
  - Abnormal plasma amino acid: high glutamine, low citrulline
  - Abnormal urine organic acids: high orotic acid

ED Management

- Immediately NPO: STOP protein intake
- High dextrose infusion (8-10+ mg/kg/min)
- Sodium benzoate/phenylacetate for ammonia scavenging
- Supplementation with arginine and/or citrulline
- Urgent metabolics/genetics consult
- May require dialysis if ammonia >500 or not improving/symptomatic

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Another Important IEM:

Organic acidemia: Glutaric acidemia type I

Presentation

- May present 3 months - 3+ years
- Symptoms/features:
  - Macrocephaly
  - Encephalopathy precipitated by illness, infection, surgery, fasting
- Labs: Biochemical findings can be equivocal
  - +/- metabolic acidosis
  - +/- hypoglycemia
  - +/- hyperammonemia
  - +/- ketonuria
  - Send: UOA, acylcarnitine profile, plasma AA (enzyme activity, genetic testing)

Higher carrier rate in some First Nations communities in Manitoba and Ontario, as well as the Lumbee Tribe of North Carolina

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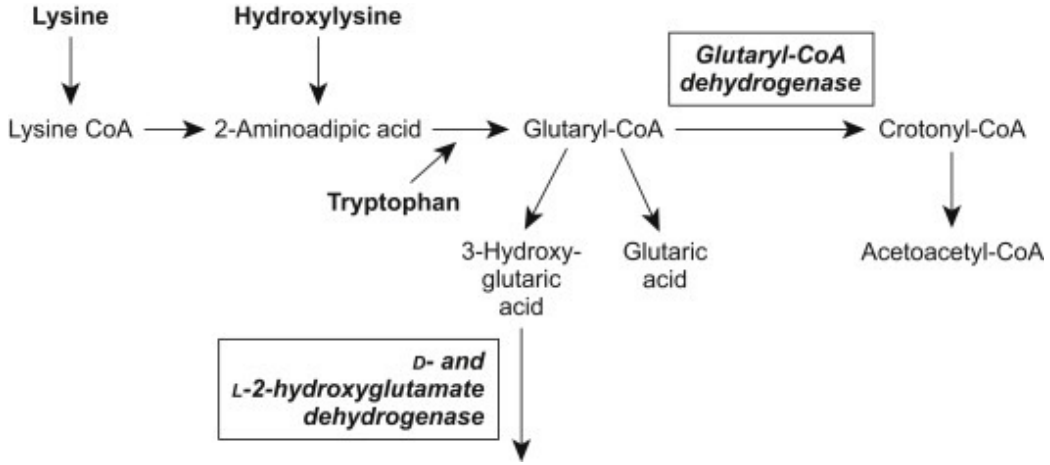

Singer et al, Metabolic disorders with associated movement abnormalities. In: *Movement Disorders in Childhood*, 3rd ed.

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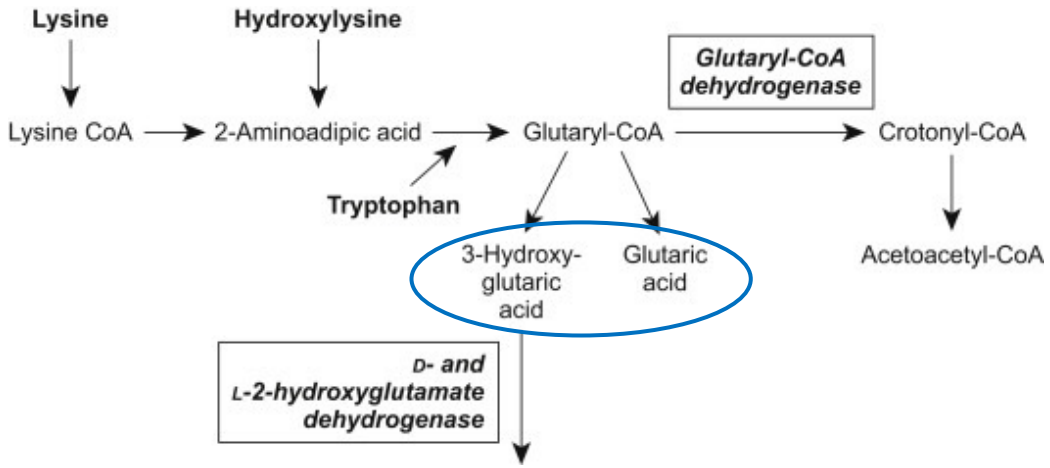

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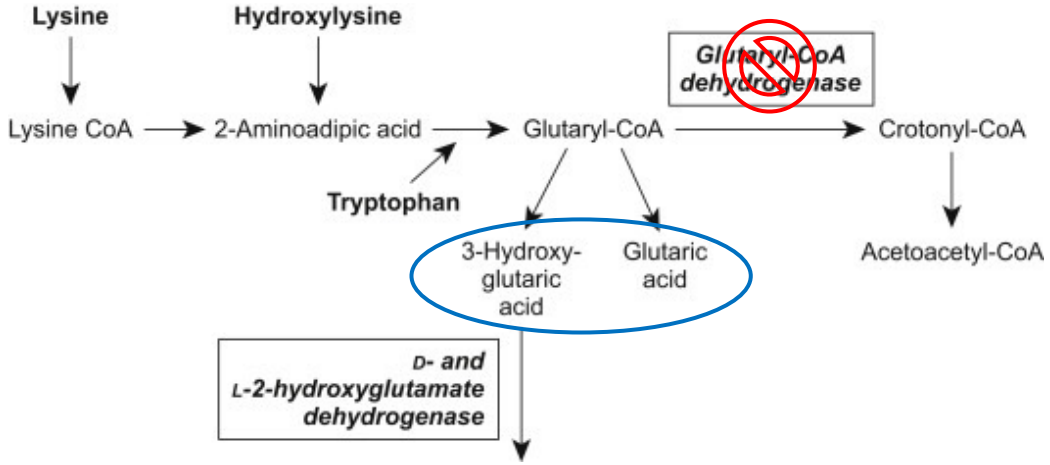

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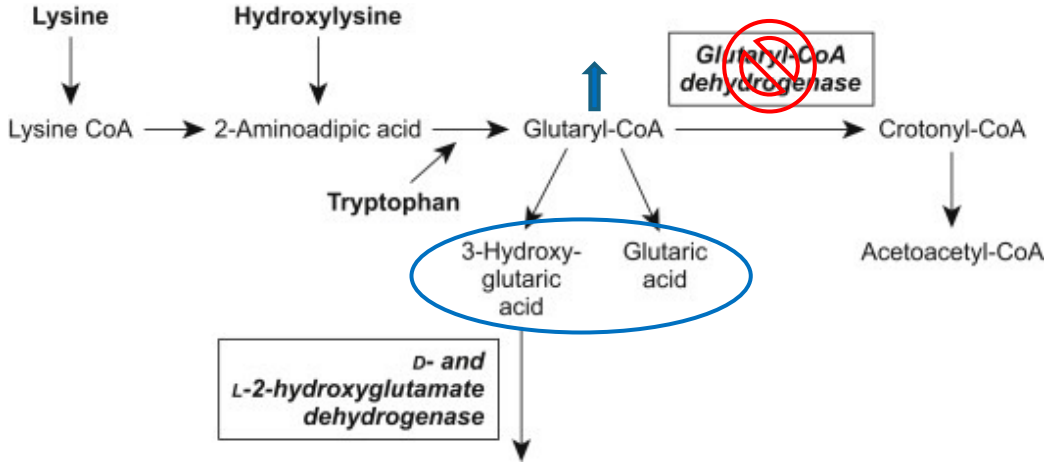

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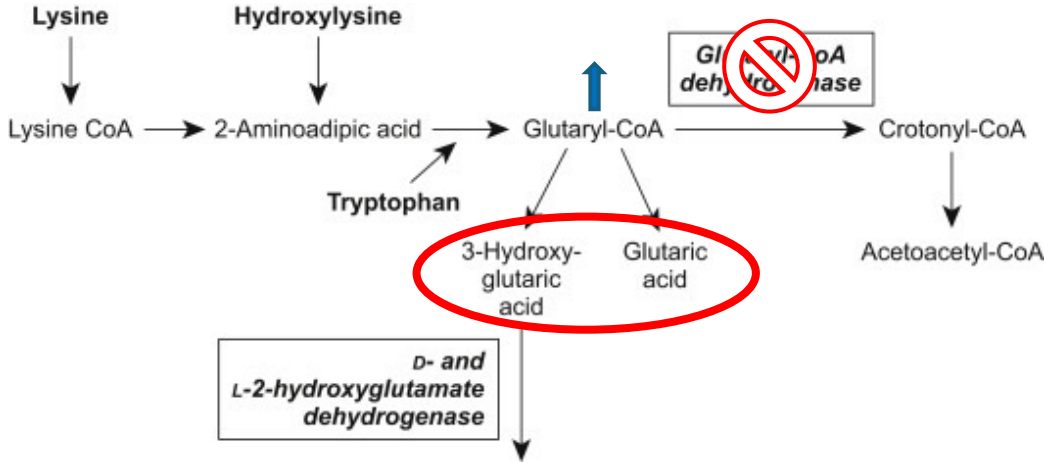

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ED Management

- Avoid catabolism– provide IV dextrose
- Urgent metabolics/genetics consult
- General: low-lysine diet, carnitine supplementation, avoid prolonged fasting

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Resuscitation & Management Pearls

Key Differences: NRP vs. PALS

Parameter	NRP	PALS
Compression : Ventilation	3:1 (pause for breath)	15:2 (2+ rescuers) 30:2 (single rescuer) Continuous compressions + 1 breath q2-3 sec if advanced airway
Compression Rate	90 compressions + 30 breaths per minute = 120 events/min	100-120 compressions/min
Fluid Bolus for Shock	10 mL/kg	10-20 mL/kg
Primary Intervention	Ventilation / Airway	Cardiac Perfusion / CAB
Vascular Access	UVC Preferred	PIV, IO

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Resuscitation Pearls: Avoid Hypothermia

Why it matters

- Increases morbidity and mortality
- Increases oxygen consumption
- Impairs coagulation
- Worsens metabolic acidosis
- Hypoglycemia

Prevention

- Warm room
- Dry baby
- Radiant warmer may be needed
- Warm humidified oxygen

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Resuscitation Pearls – Vascular Access

Umbilical Vein Catheter

- First choice for neonatal emergency access
- Insert 4-5cm until blood return

Intraosseous (IO) Access

- Alternative if UVC is unsuccessful or not feasible
- Proximal tibia is preferred site

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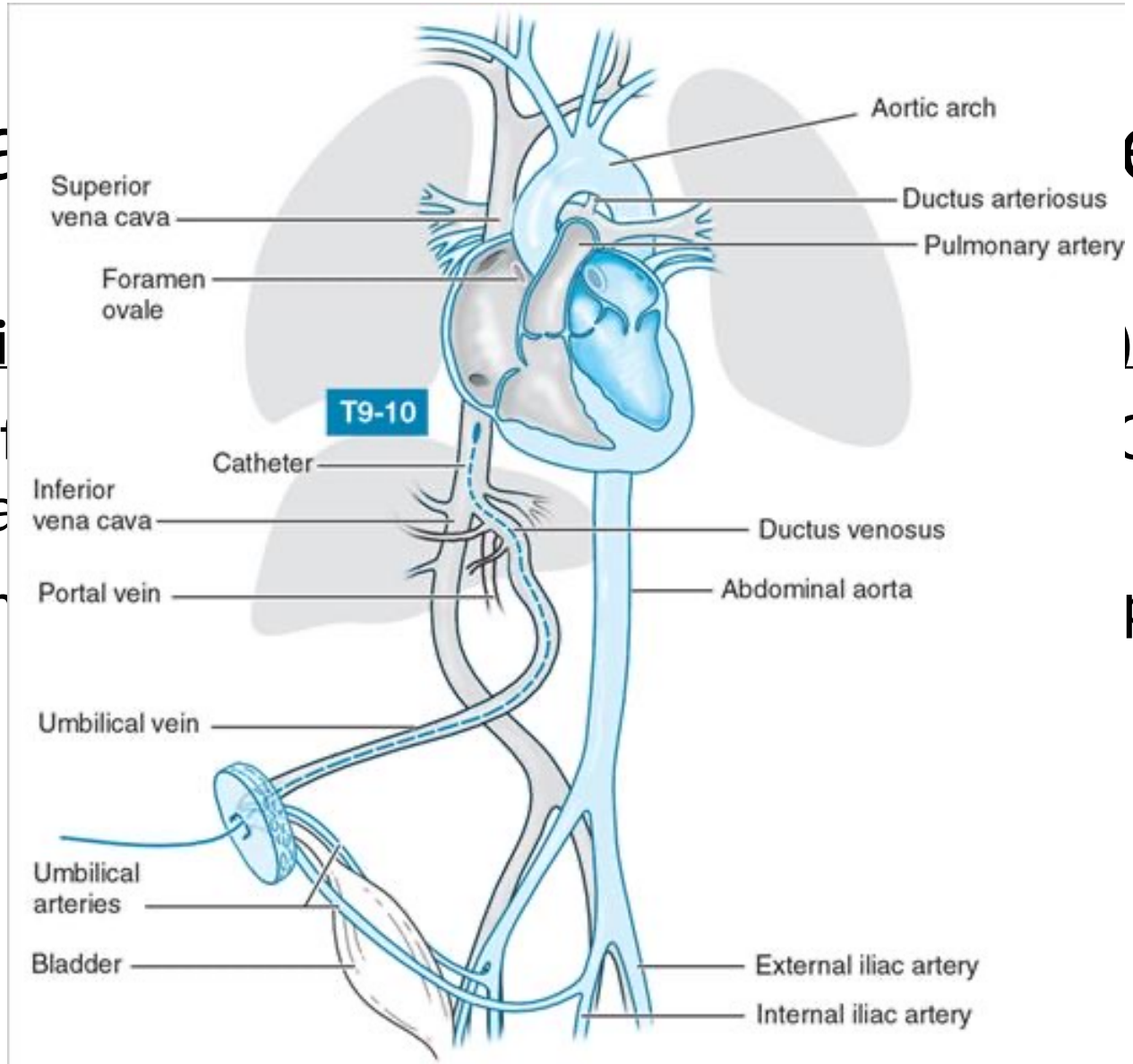
Resuscita ess

Umbilical Vei Access

- First choice f C is emergency a not feasible
- Insert 4-5cm preferred site



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Resuscitation Pearls – Communication

Team Dynamics

- Assign roles
- Closed-loop communication
- Speak up if concerned
- Updates and summary statements

Family Communication

- Most parents want to be present during their child's resuscitation
- Can help improve understanding and processing, and provide a greater sense of control
- Presence of a facilitator to support families is beneficial and can reduce parental anxiety during resuscitation
- Identify and include key stakeholders in the paging system for resuscitations

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Resuscitation Pearls – Taking Notice

Compensated Shock

- Hypotension is a ***late*** finding in neonates
  - And what is “hypotension” in a neonate, anyway?
- Monitor end-organ perfusion
  - ***Trend*** is helpful
- CO = HR X SV = SBP/SVR

Failed Airway Attempts

- Limit attempts in # and time
- Consider LMA early
- Bag-mask ventilation can be life-saving while waiting for help
  - *Vent the stomach as able*

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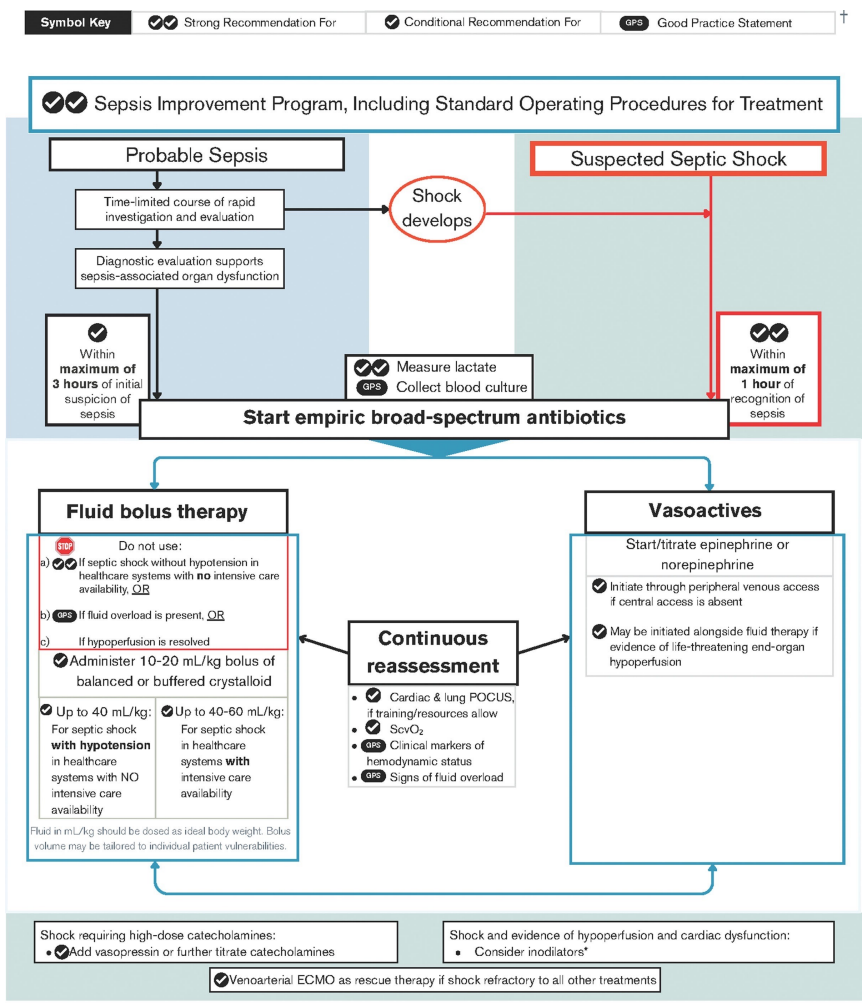
Resuscitation Pearls – Taking Notice

Antibiotic Administration

- Timing is critical
- Blood culture obtained, infant is ill -> give abx
- Don't delay for LP if unstable



Weiss et al, Pediatric Critical Care Medicine April 2026

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Summary and Takeaways

- Ventilation is key in neonatal resuscitation
- Use corrective steps to ventilation
- LMA is your friend
- Get a gas with a lactate, an ammonia, and a sugar for an ill-appearing neonate
- Avoid hypothermia
- PGE1 for ductal-dependent lesions
- Stop protein, give glucose for suspected metabolic crises
- Early antibiotics saves lives in sepsis
- Consider the UV
- Partner with families

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Thank you!

Questions?

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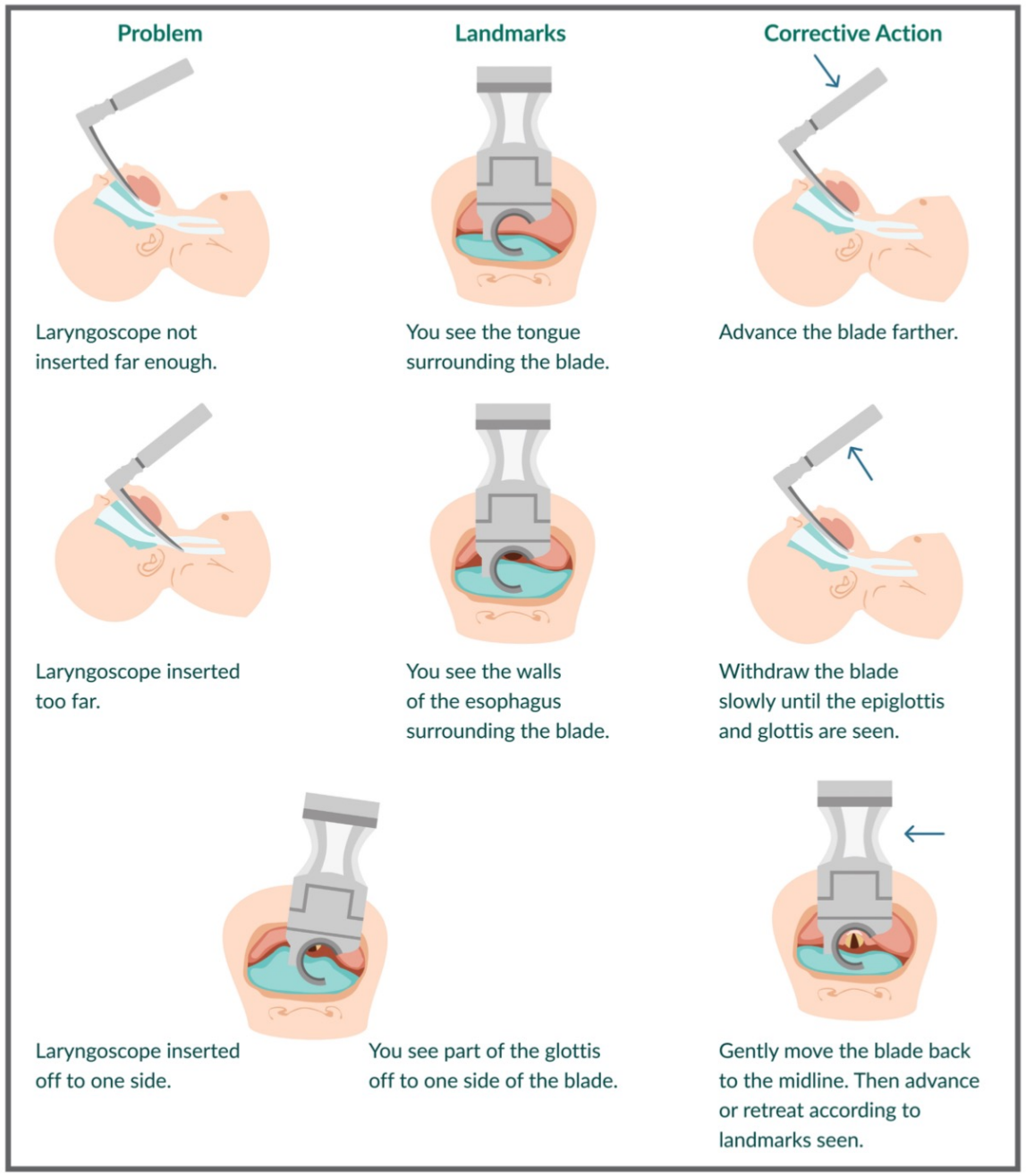

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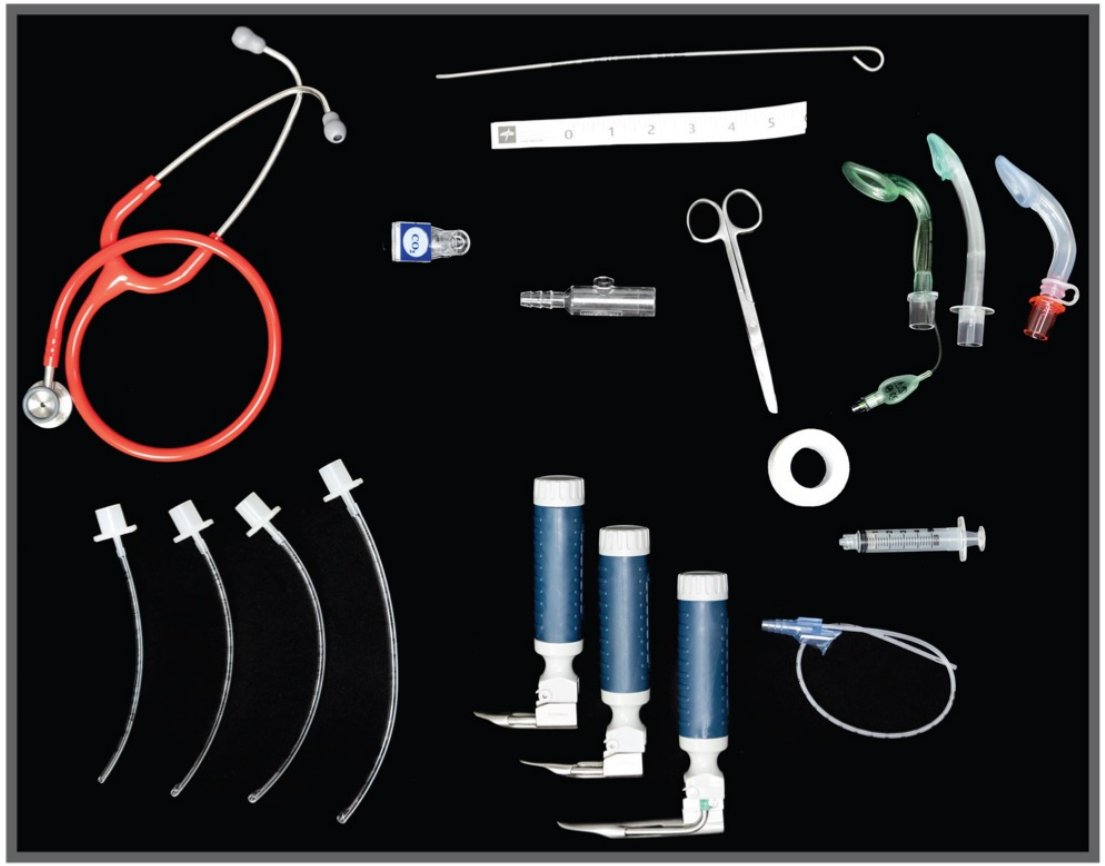

Table 5-1. Endotracheal Tube and Suction Catheter Size for Newborn Infants of Various Weights and Gestational Ages

Weight (grams)	Gestational Age (weeks)	Endotracheal Tube Size (mm ID)	Suction Catheter (F)
< 800	22–25	2.5*	5
800–1,200	26–28	2.5	5 or 6
1,201–2,200	29–34	3.0	6 or 8
>2,200	>34	3.5	8

* A 2.0 mm ID endotracheal tube (optional) may be considered.