Pediatric Panel: Anesthesia Literature Update and Challenging Cases

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Anschutz

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Learning Objectives

- Upon completion of this activity, learners will be able to
  - Discuss recent publications relevant to pediatric anesthesia.
  - Integrate evidence-based data for common challenges in pediatric anesthesia.
  - Implement effective management strategies for pediatric patients receiving anesthesia.

2

Literature Review

PAAD Pediatric Anesthesia Article of the Day

Pediatric Anesthesia

ANESTHESIOLOGY

BJA Education

ANESTHESIA & ANALGESIA

3

Anesthesia in Patients of Maternal Venezuelan Descent (Summer 2025)

Initial Reports from Society of Anesthesiology of Chile

- 5 children with severe adverse neurologic outcomes and 4 deaths
- Identified previous report from Spain → 6 children with severe neurologic damage after sevoflurane exposure
- All children of Venezuelan descent
- All in Spain report and one in Chilean report had a mitochondrial mutation in common

ASA/SPA Statement: report any concerning cases, but insufficient data to make recommendations

ASA and SPA statement regarding care of Venezuelan children

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Anesthesia in Patients of Maternal Venezuelan Descent (Jan 2026)

Additional Reports: 36 patients worldwide

- Includes 6 in the United States
- Previously healthy adults and patients
- Delayed emergence → intracranial HTN, cerebral edema, basal ganglia infarcts, hypoxic ischemic encephalopathy
- Most patients died

Updated ASA/SPA Statement: recommendations for screening, genetic testing, and anesthetic management

Updated Joint Statement from SPA and ASA

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Anesthesia Patients of Maternal Venezuelan Descent

- Mitochondrial mutation on complex I (ND4 gene)
  - In vitro: highly sensitive to sevoflurane at low concentrations, no response to propofol
  - No point-of-care screening available
- Updated reports from Chile
  - 20% of patient population is Venezuelan
  - Change to propofol TIVA with processed EEG
  - No new cases since changing to TIVA (including 4 patients with known mitochondrial mutation)

6

Joint ASA and SPA Recommendations

Screen for Risk

- Screen for maternal Venezuelan ancestry
- Be sensitive to current cultural and political climate

Genetic Testing

- Consult local genetic expert for recommendations
- Mutation of interest (mtND4 m.11232T>C) has previously been reported as a normal variant

Clinical Management for Patients at Risk

- Avoid volatile agents → use TIVA
  - Propofol is presumed safe (unknown effect of prolonged infusions)
  - No issues: midazolam, dexmedetomidine, ketamine, and opioids
- Regional anesthesia when appropriate
- Processed EEG to avoid burst suppression
- Postop monitoring until return to cognitive baseline

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Pediatric Resuscitation

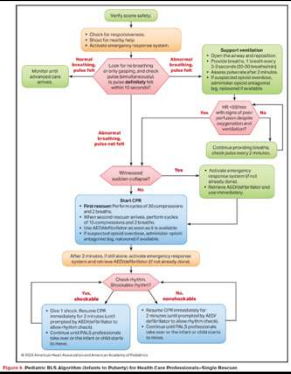
- Rescue breaths are back!
- Emphasized puberty cut-off
- Naloxone is in the BLS algorithm
- Changes to infant compression technique
- Updates in post-resuscitation management

8

Pediatric Basic Life Support

- Rescue breaths emphasized
  - Peds: 1 breath every 2-3 seconds (20-30/min)
  - Adult: 1 breath every 6 seconds (10/min)
- Naloxone added to main BLS algorithm
- AED placement emphasized (use attenuator if available)

Part 6: Pediatric Basic Life Support



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Pediatric Compression Technique

No longer recommended: Two finger technique for infants



Part 6: Pediatric Basic Life Support

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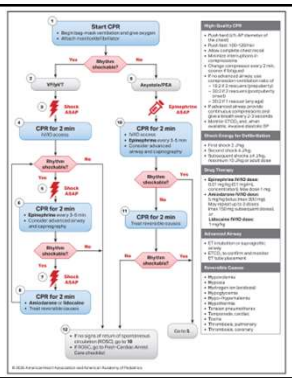
Pediatric Advanced Life Support

- Changes from 2020
  - Updated compression : ventilation ratios
    - Pre-puberty: 15:2
    - Post-puberty: 30:2
  - Endotracheal epinephrine removed from algorithm
  - Diastolic blood pressure targets
  - Measuring CPR Quality
    - $EtCO_2$ (≥20mmHg?)
    - Diastolic BP
      - Infants: ≥25mmHg
      - ≥1yo: ≥30mmHg

Part 8: Pediatric Advanced Life Support



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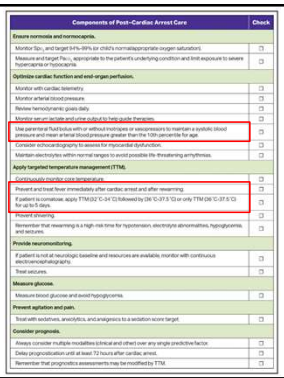
Post-Cardiac Arrest Care

- Updated guidelines
  - Prevent hyperthermia
  - SBP >10th percentile for age

Part 8: Pediatric Advanced Life Support



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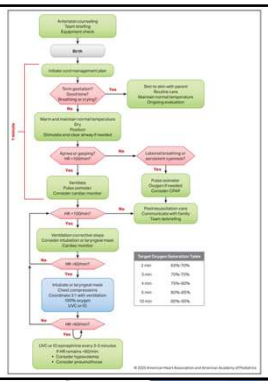
Neonatal Resuscitation

- Airway management
  - Emphasis on video laryngoscopy and LMA placement
  - Ventilation rate: 30-60/min
  - Removed 1min O_2 sat target
  - FiO_2 recommendations
    - ≥35wks GA: 21%
    - <32wks GA: ≥30%
- Delayed cord clamping extended to 60s



Part 5: Neonatal Resuscitation

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Perioperative Resuscitation Guides

- SPA PediCrisis App
- https://pedsanesthesia.org/pedi-crisis-app/

- Perioperative Resuscitation and Life Support (PeRLS) (3rd version)
- Moitra VK, et al. Anesthesiology. 2025. 143(6):1453-1483.
- Cause-directed resuscitation rather than generic arrest algorithms

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Pediatric Airway Management

- Airway Algorithms
- Pediatric Difficult Intubation Registry
- Front-of-Neck Access
- Fasting Guidelines
- POCUS

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Difficult Airway Society (2015)

- Pediatric algorithms (1-8yo)
  - Difficult mask ventilation
  - Unanticipated difficult tracheal intubation
  - Cannot intubate and cannot ventilate (CICV)
- Specific peds considerations
  - Head/neck positioning
  - Equipment size
  - Laryngospasm, bronchospasm
  - Light anesthesia, inadequate NMB
  - Gastric distention from mask ventilation
  - Age recommendations for front of neck access
  - No awake intubation recommendation

https://das.uk.com/guidelines/paediatric-difficult-airway-guidelines/

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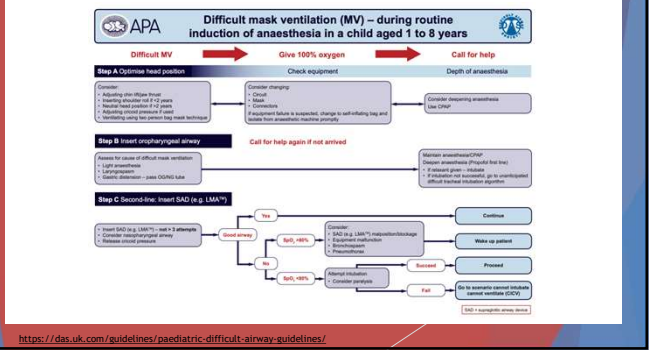

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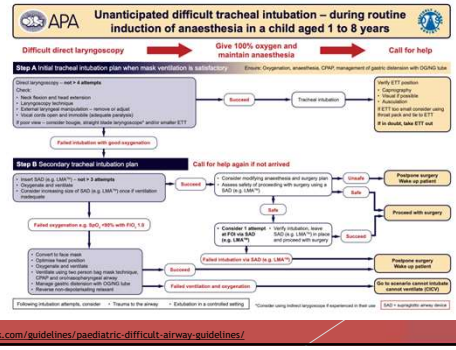

https://das.uk.com/guidelines/paediatric-difficult-airway-guidelines/

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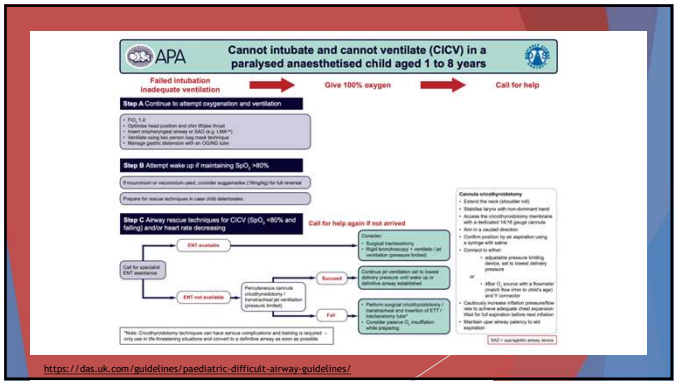

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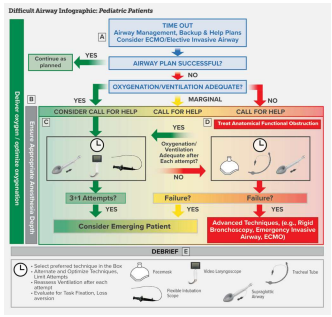
ASA Difficult Airway Algorithm for Pediatric Patients (2022)

- Address anatomic or functional obstruction
- Deliver oxygen throughout
- "3+1" attempts
  - 3 for primary provider
  - 1 for senior provider
- No clarity on age restrictions for surgical airway



Apfelbaum. Anesthesiology. 2022.

20

ESAIC and BJA Joint Guidelines for Neonatal and Infant Airway Management (2024)

- Video laryngoscopy
- Apneic oxygenation
- Adequate depth of anesthesia
- Neuromuscular blockade
- Limit intubation attempts
  - 1 for trainee
  - 3 for senior physician
- Supraglottic airway for rescue
- Advanced techniques
  - Rigid bronch
  - eFONA (surgical trach)
  - ECMO

Disma. Eur J Anaesthesiol. 2024.
Disma. BJA. 2024.

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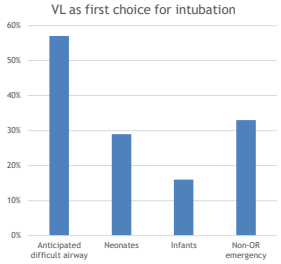
Are We Actually Following Recommendations?

- Video Laryngoscopy
  - Highly available (93% of peds ORs; 80% of non-OR locations)
  - Underutilized for neonate and infant intubations
- Apneic Oxygenation
  - 30% use during difficult intubation
  - 28% have never used it



Bai. Pediatric Anesthesia. 2025.

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Pediatric Difficult Intubation Registry

Reference	Summary
Fiadjoe. Lancet. 2016.	Airway complications in children with difficult intubation - >2 DL attempts and <10kg weight are associated with increased failure and complications
Burjek. Anesthesiology. 2017.	VL vs FOI through LMA in children with difficult airway - Similar 1st attempt success rate - FOI through LMA is more successful with less hypoxemia in infants
Garcia-Marcinkiewicz. Anesth Analg. 2020.	Spontaneous vs controlled ventilation during difficult airway management - Spontaneous ventilation → more complications, likely due to inadequate anesthetic depth
Sequera-Ramos. Anesthesiology. 2022.	Sedation vs GA for intubation in children with difficult airways - Similar success and complications rates - 28% of sedation cases needed conversion to general anesthesia
Stein. Anaesthesia. 2025.	VL vs FOI as a rescue after failed DL - VL is chosen more often, but success and complications are similar - For infants <5kg, success was higher with FOI than VL (90% vs 71%)
Lin. Anaesthesia. 2025.	Combined VL + FOI (hybrid technique) for difficult intubation - Hybrid technique was associated with higher success and lower complications compared to VL and DL
Bordini. BJA. 2025.	Cognitive errors in difficult airway management - Cognitive errors occur in 20% of difficult airway encounters and were associated with increased complications - Common errors – fixation errors, omission bias, overconfidence bias
Crockett. Anaesth. 2025.	Impact of weekend vs weekday cases - Complication rates were 2x higher on weekends compared to weekdays

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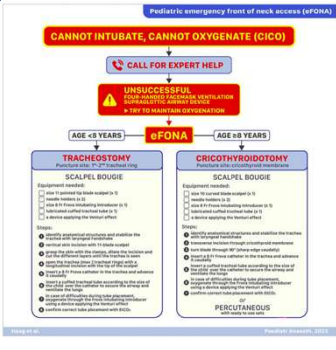
Emergency Front-of-Neck Access (eFONA)

- Narrative review of indications, technique, equipment, and complications of eFONA in peds



Haag. Pediatric Anesthesia. 2024.

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POCUS for Airway Management

- Identifying airway sonoatomy
- Predicting difficult DL
- Estimating ETT size
- Confirming endotracheal intubation
- Guiding FONA

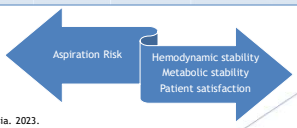
Measure transverse diameter of the air column at the level of the cricoid cartilage
Gomes. Anesth Analg. 2024.

Gomes. Anesth Analg. 2024.
Lohse. BJA Education. 2025.

25

Pediatric Preoperative Fasting Guidelines

Society	Clear Fluids	Breast Milk	Formula and Non-Human Milk	Solids (light meal)	Year
ANCZA	1 (3mL/kg/hr)	3-4	4	6	2017
APAGBI	1	4	6	6	2018
CAS	1	4	6	6	2021
ESAIC	1	3	4	4-6	2022
ASA	2	4	6	6	2017, 2023



Zhang. Pediatric Anesthesia. 2023.

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US Peds Institution Survey Data

	SPA (Glenski)	PALC (Dalal)
Current department clear fluid recommendation		
• 1hr	24%	20%
• 2hr	73%	80%
Would 1hr be beneficial/ideal?	71%	70%
If ASA updated recommendations, would your department update?	86%	
Concerned about medicolegal implications of changing guidelines without ASA statement?		73%
Should ASA revise guidelines to be peds specific?		95%

Glenski. Pediatric Anesthesia. 2025.
Dalal. Anesth Analg. 2025.

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Adverse Effects After 1 Hour Clear Fluid Fasting Recommendation

- Swiss anesthesia institutions
- Patients 0-15yo undergoing elective procedures given instructions for 1hr CF fast
- Median effective CF fast = 157min
- No difference in adverse events for CF fast <2h vs ≥2h

	CF fast <2h	CF fast ≥2h
Age (yrs)	5.7	6.1
CF fast time (min)	89	234
Aspiration	0.12%	0.11%
Regurgitation	0.16%	0.14%
Vomiting	0.29%	0.39%

Schmitz. BJA. 2024.

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Gastric US to Evaluate Modified Fasting Protocol

- Patients <3yo scheduled for elective TTE under sedation
- Prospectively randomized to two groups
  - Standard fasting - Stop food and water x4 hrs prior
  - Modified fasting - Stop food x4 hrs, continue water until 1 hr prior
- Evaluated with gastric US
  - Qualitative - empty vs fluid contents vs solid contents
  - Quantitative - gastric antrum cross-sectional area (CSA), gastric volume (GV)

	Standard Fast	Modified Fast
Age (mo)	16.8	15.2
Effective Fast Time (hrs)	4	2
CSA_{RLDP45} (cm^2)	2.38	2.56

Cho. Pediatric Anesthesia. 2025.

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Gastric POCUS in Infants

- Fasted, ASA I-II patients, <24 months old presenting for GI procedures
- Gastric POCUS in supine and RLD positions followed by suctioning of gastric contents
- Volume of gastric contents
  - Correlated with age, BMI, and RLD CSA
  - Did not correlate with fasting time or supine CSA
- RLD CSA <2.4cm^2
  - 100% sensitive and 69% specific for an empty stomach
  - Negative predictive value = 100%

Sever. Pediatric Anesthesia. 2024.

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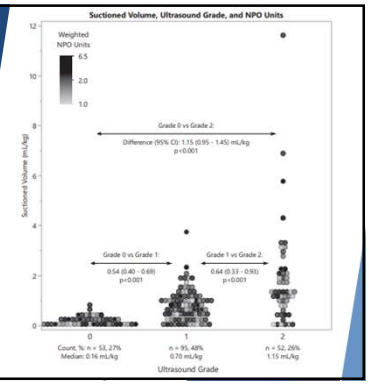
Gastric POCUS in Long-Bone Fractures

- Pediatric patients presenting for long-bone fracture repair
- POCUS conducted before induction, then gastric suction after induction
- Results
  - Gastric volume correlates with POCUS grade
  - Gastric volume did not correlate with NPO status, opioid administration
  - NPO status did not correlated with gastric volume or POCUS grade



Soneru. Pediatric Anesthesia. 2024.

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Point-of-Care Ultrasonography in Children

- Indications, limitations, and technique for POCUS in children
- Exams reviewed
  - Airway – TT position, depth, and size
  - Lung – pleural pathology (pneumothorax, effusion)
  - Gastric – volume, content consistency
  - Cardiac (FATE) – effusion, LV systolic dysfunction, ventricular filling, ventricular standstill
  - Neonates – cerebral exam (IVH), NEC evaluation
  - FAST exam

Eaddy. BJA Education. 2025.

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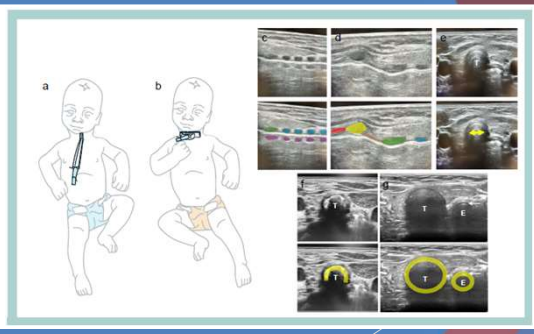

Eaddy. BJA Education. 2025.

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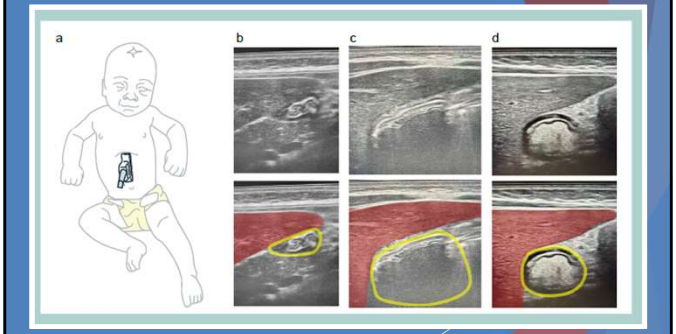

Eaddy. BJA Education. 2025.

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Cardiac Topics

- Intraoperative Events
- Children and Adults with CHD
- Pediatric Arrhythmias

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Current State of Peds Cardiac Anesthesia

Survey Results:

- 31% of peds cardiac anesthesiologists are considering leaving the field
- Division chiefs predict 129 new hires needed in next 5 years
- 21/34 fellowship positions filled in 2023

Will need:

- Changes in staffing ratios
- Cardiac patients cared for by non-cardiac attendings

Nicolson. Anesth Analg. 2026.

36

Intraoperative Cardiac Events in Patients with CHD Presenting for Non-Cardiac Procedures

- 5.2% had an intraoperative cardiac event (hypotension, arrest)
- Intraop event associated with 5x increase in 30d mortality
- Staffing Implications
  - No difference for peds vs peds cardiac anesthesia
  - 1:2 coverage associated with least hemodynamic instability --> reflects institutional protocols to triage and staff cases appropriately

Increased Risk	No Increased Risk
• Major or severe CHD • Emergent procedure • Inpatient status • Concurrent respiratory illness • Preoperative inotropic support • Intraop mechanical ventilation	• Prematurity • Sleep apnea • Chromosomal abnormality • Anesthetic type • Provider background

Nasr. Anesthesiology. 2026.

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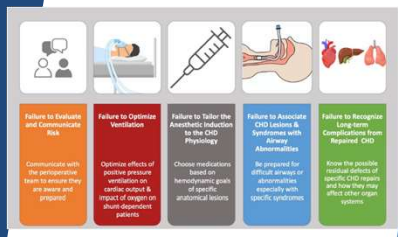
Error Traps in the Management of Children with CHD

Highest Risk:

- Cardiomyopathy
- Pulmonary hypertension
- LV outflow tract obstruction
- Single ventricle physiology



Albertz. Pediatric Anesthesia. 2024.

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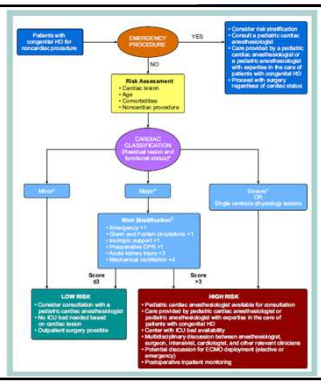
Children with CHD Presenting for Non-Cardiac Procedures

- CHD review
  - Cardiac physiology
  - Systemic manifestations
- Clinical management pathway
  - Preop risk stratification and optimization
  - Appropriate care team members
  - Suspected undiagnosed CHD



Spiro. BJA Education. 2024.

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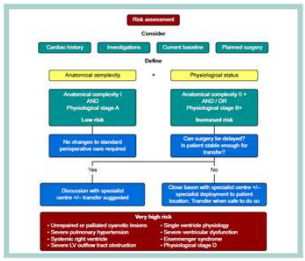
Adults with CHD Presenting for Non-Cardiac Proceures

- Composite risk assessment includes
  - Type of CHD lesion
  - Current physiologic status
  - Surgical risk
- Papers include
  - Review of lesions
  - Perioperative management

Tafer. Anaesth Crit Care Pain Med. 2025.



Tafer. Anaesth Crit Care Pain Med. 2025.
Wild. BJA Education. 2025.

Wild. BJA Education. 2025.

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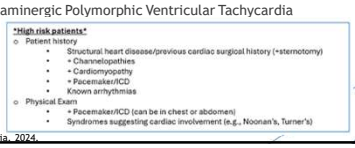
Pediatric Arrhythmias

- Review
  - Common arrhythmias and ECG interpretation
  - General anesthetic planning
- Specific recommendations for
  - Wolff-Parkinson-White
  - Junctional Ectopic Tachycardia
  - Congenital Long QT Syndrome
  - Catecholaminergic Polymorphic Ventricular Tachycardia



Kuntz. Pediatric Anesthesia. 2024.

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Special populations that should have plan outlined in conjunction with a cardiologist

Long QT Syndrome

- Channelopathy caused by variety of gene mutations. Different subtypes have different triggers.
- Places patients at risk for polymorphic ventricular tachycardia (Torsades de Pointes, TdP)
- Treatments include beta blockade, internal cardiac defibrillator, and sympathetic denervation surgery
- High Risk Characteristics
  - QTc > 500 ms
  - Certain subtypes: LQTS2 and LQTS3 > LQTS1
  - Symptomatic episodes (syncope, cardiac arrest): cardiac arrest before 1 year of age
- Anesthetic Planning
  - Choose medications that do not increase QT or transmural dispersion of repolarization (crediblemeds.org)
  - Continue home beta blockers
  - Treat tachycardia, consider esmolol
  - $MgSO_4$ 25 – 30 mg/kg (max 2 g) then infusion (0.5-1.0 mg/kg/hr) for TdP
  - Defibrillation available

Catecholaminergic Polymorphic Ventricular Tachycardia

- Channelopathy with ventricular tachycardia results in times of stress
- Treatments include non-selective beta blockers, internal cardiac defibrillator, and sympathetic denervation surgery
- High Risk Characteristics
  - Increased sympathetic tone: exogenous catecholamines or emotional stress
  - Episodes despite pharmacologic therapies
  - History of implantable defibrillator placement
- Anesthetic Planning
  - Avoid stress and catecholamine surges: maintain deep plane of anesthesia
  - Non-sympathomimetic vasopressors (e.g., phenylephrine) preferred
  - Exogenous epinephrine counterproductive during cardiac arrest
  - Emphasize arrhythmia control during resuscitation. Give beta blockers (esmolol)

Kuntz. Pediatric Anesthesia. 2024.

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Odds and Ends

- Nitrous Oxide
- Neuromuscular Blockade
- Perioperative Vaccination

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Nitrous Oxide for Pediatric Mask Induction

Reasons to stop

- Precludes pre-oxygenation in patients with
  - Decreased FRC
  - Higher O2 consumption
  - Increased risk of laryngospasm
- Does not reliably improve
  - Mask or sevoflurane tolerance
  - Speed of induction (second gas effect)
- Increases occupational exposure
- Environmental impact

Gordon. Pediatric Anesthesia. 2024.

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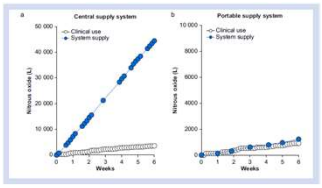
Decommissioning Central Nitrous Oxide

- Central Supply System
  - Large volume central supply with constant pressure through multiple connection points
  - 83-100% of procured N_2O is lost before reaching the patient
- Transition to portable N_2O supply
  - 97.6% decrease in N_2O utilization
  - Median exchange frequency = 414 days
- 2024 ASA statement: recommend transitioning to portable N_2O supply

Chesebro. BJA. 2024.
ASA statement on deactivating central N2O

Pediatric Anesthesia Article of the Day



Chesebro. BJA. 2024.

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Effect of Neuromuscular Blockade on Tracheal Intubation Quality in Children

- Drug selection
  - Succinylcholine and rocuronium provided the best conditions
  - Opioids improved hemodynamics, but not intubating conditions
- Age-related effects
  - Intubation without NMB is most difficult in neonates/infants
  - <4yo: Intubation with/without NMB are equivocal
  - >4yo: Intubation without NMB worsens

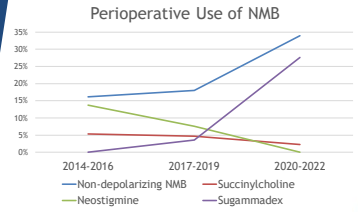
Vanlinthout. BJA. 2025.

46

Use of Neuromuscular Blockade Since Sugammadex Introduction

- NMB is more commonly used
  - since introduction of sugammadex (OR 5.6)
  - for teenage children (OR 7)
  - by trainees (OR 1.2)
- *Despite overall shift from ETT to LMA during this time period

Brown. Anesth Analg. 2025.



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Incidence of Residual Neuromuscular Blockade in Children

Standard intraop practice with qualitative monitoring → Reversal with neostigmine or sugammadex → Quantitative assessment for residual block in PACU

- Residual blockade increased
  - After neostigmine reversal (OR 29.8)
  - With increasing weight (OR 1.05)
  - No effect - rocuronium dose or time from last dose
- All patients with residual block had qualitative TOFc = 4 prior to extubation

Faulk. Cureus. 2024.

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Factors Contributing to Residual NMB in Children <2 years old

- Assessed incidence and factors contributing to sugammadex redose after standard care
- Sugammadex redose
  - 4.2% of all patients
  - Within 7 minutes of initial dose
  - 4.2% needed >1 rescue dose

Factors Associated with Redose	Factors Not Associated With Redose
• Decreased age • Decreased weight	• Last rocuronium dose • Initial sugammadex dose • Intraoperative TOF monitoring • Neuromuscular disorder

Cates. Pediatric Anesthesia. 2024.

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Perioperative Influenza Vaccination

Preoperative Vaccination

- Intervention: PDSA process to promote vaccination during preop clinic visit
- Outcomes
  - Increased vaccination rates across 3 seasons (goal >18%)
  - No case cancellations

Meyer. Pediatric Anesthesia. 2024.

Intraoperative Vaccination

- Intervention: Process to identify unvaccinated patients and offer flu shot in preop holding → intraop administration
- Outcomes
  - 6x increase in vaccination rate (13.6%)
  - No increase in postop fevers
  - No increase in adverse events in hospital reporting system

Strupp. Anesthesiology. 2022.

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CLINICAL CASES

51

Case #1

- A **6-year-old 22 kg male** presents emergently from the ED for **exploration and repair of an open globe injury**
- History
  - Injury occurred ~2 hours ago
  - Struck by a metal rod
  - Significant eye pain and anxiety
  - Last oral intake: unclear — family reports "maybe a snack after school"

52

Case #1 cont.

- Exam
  - Awake, crying, anxious
  - Nauseated, intermittently gagging
  - SpO2 100% on room air
  - Mallampati not assessable
  - Mild upper airway obstruction when supine due to agitation
- Surgical considerations
  - Emergent repair
  - Avoid coughing, bucking, or vomiting

53

Discussion

- What is your induction strategy?
- How would you proceed after an unsuccessful first intubation attempt?
- Do you have pediatric VL equipment available?
- Do you use apneic oxygenation?

54

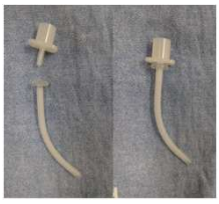
Pediatric Difficult Airway ≠ Anatomic Only

Functional difficulty

- Emergency
- Aspiration risk
- Need to avoid coughing
- Limited cooperation

These are exactly the situations where algorithm deviation occurs

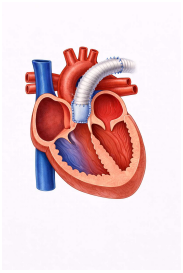
55



Apneic Oxygenation: Low Cost, High Yield

- Only ~30% of clinicians routinely use it during pediatric difficult intubation
- Particularly valuable in
  - RSI
  - High oxygen consumption states
  - Anxiety/agitation

56



Case #2

- A 9-year-old 28 kg female presents for urgent laparoscopic appendectomy
- Congenital heart disease
  - Repaired Tetralogy of Fallot
  - RV-PA conduit placed in infancy
- Last cardiology visit: 18 months ago
- Parents report
  - "She gets tired faster than her friends"
  - Occasional dizziness with exertion
- No prior anesthetic complications

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Preoperative Assessment

- Preop vitals
  - HR 135
  - BP 90/55
  - Temp 38.6°C
  - SpO_2 97% on room air
- No recent labs
- No recent ECG available
- Last echo (18 months ago)
  - Moderate RV dilation
  - Mild RV dysfunction
  - Mild pulmonary regurgitation
- Surgery is requesting to proceed promptly

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Discussion

- Which aspects of this history should raise concern for increased perioperative risk?
- Which physiologic feature is most concerning in this patient?
- How would you staff this case?
- What complications should you anticipate?

59

Key Considerations

- RV-dependent circulation
- Risk of acute RV failure
- Effects of
  - Hypoxia
  - Hypercarbia
  - Increased PVR
  - Positive pressure ventilation
- Hemodynamic impact of pneumoperitoneum

60

Intraop

Induction

- IV induction with fentanyl, propofol, rocuronium
- Smooth intubation
- Initial vitals stable

After pneumoperitoneum

- Sudden hypotension
- Rising $EtCO_2$
- Decreasing SpO_2
- Poor response to phenylephrine

61

Discussion

- What's your differential?
- What action do you take?

62

Management

Actions taken

- Pneumoperitoneum released
- FiO_2 increased
- Ventilation adjusted to avoid hypercarbia
- Inhaled nitric oxide initiated
- Epinephrine infusion started
- Communication with surgery regarding urgency vs physiology

Hemodynamics improve

Surgery converted to open approach

Patient transferred to ICU postoperatively

63

CHD Risk Is About Physiology, Not Repair Status

- Large cohort data show ~5% incidence of intraoperative cardiac events
- These events are associated with 5× increased 30-day mortality
- Risk is driven by
  - Ventricular dysfunction
  - Pulmonary hypertension
  - Outflow obstruction

64

Right Ventricle Is the Achilles' Heel

RV is exquisitely sensitive

- Increased afterload
- Hypoxia
- Acidosis

Laparoscopy and positive pressure ventilation are not benign in RV-dependent physiology

65

Staffing Matters — But Not the Way We Think

Nasr et al.

- No difference in outcomes between pediatric vs cardiac anesthesiologists
- 1:2 anesthesia coverage associated with least hemodynamic instability

Reflects

- Better situational awareness
- Ability to manage physiology while coordinating with surgery

66

Preop Optimization Is Often Missed in Urgent Cases

- Common error traps
  - Proceeding without recent echo/ECG
  - Underestimating functional symptoms
  - Treating "urgent" as "can't pause"

67

Anticipate the Inflection Points

High-risk moments in CHD non-cardiac surgery

Induction	Initiation of positive pressure ventilation	Pneumo-peritoneum	Positioning	Emergence

Proactive planning beats reactive rescue

68

Discussion

- What would you change in your own practice for CHD patients undergoing non-cardiac surgery?

69

Case #3

- A 4-year-old, ASA I, presents for tympanostomy tubes
  - No URI
  - Anxious but cooperative
  - Plan: mask induction
- The anesthetic machine is set up with 70% nitrous oxide / 30% oxygen to "smooth the induction"

70

Discussion

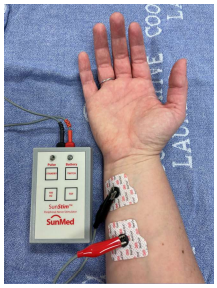
- Are you still using nitrous oxide in your practice?
- How is nitrous delivered? Pipeline? Tank?

71

Nitrous Oxide

- Nitrous precludes effective preoxygenation
- Children have:
  - Lower FRC
  - Higher oxygen consumption
- In the event of airway obstruction, you have less margin, not more
- Recent literature questions whether nitrous meaningfully improves tolerance or speed of induction

72



Case #4

- A 2-year-old undergoes laparoscopic inguinal hernia repair
  - Rocuronium used for intubation
  - Reversed with neostigmine
- At end of case
  - TOF count = 4 (qualitative)
  - Extubated awake
- In PACU, the child has
  - Shallow respirations
  - Poor head lift
  - Hypoxemia

73

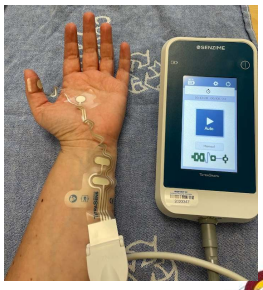
Which statement is most accurate?

- Would you use a neuromuscular blockade monitor in this case?
- Quantitative or qualitative?
- What reversal agent would you use?

74

Neuromuscular Blockade

- Residual neuromuscular blockade still occurs in children
- All patients with residual block in recent studies had TOFc = 4 before extubation
- Neostigmine reversal is associated with much higher odds of residual weakness
- Sugammadex does not eliminate risk — but changes rescue patterns



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Case #5

- A **7-year-old**, ASA I, presents for elective orthopedic hardware removal
  - Preop nurse notes child is **not vaccinated for influenza**
  - It's peak flu season
  - Parents ask:
    - "Can she still get her flu shot today?"


Photo by Ed Us on Unsplash

76

Discussion

- How would you respond?
- Is your institution allowing vaccinations under anesthesia?
- Is your institution offering vaccinations under anesthesia?

77

Perioperative Vaccination

Perioperative influenza vaccination
- Increases vaccination rates
- Does not increase cancellations
- Does not increase postop fevers or adverse events

Intraoperative administration removes
- Access barriers
- Missed opportunities

This is a systems-level win with minimal patient risk

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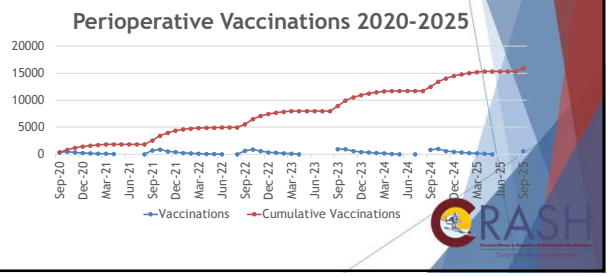
Children's Hospital Colorado Data



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The Pediatric PACU

The Last Frontier

80

Anesthesia to the PACU!

81

Top Pediatric PACU ISSUES

- Respiratory
- PONV
- Temperature
- Emergence Delirium

82

Upon arrival to PACU you are greeted with…

2 Year old s/p Strabimus Surgery

83

What to do Next?

- Intraoperative medications?
- Sufficient Prophylaxis?
- Rescue Options?
- Considerations based on age?

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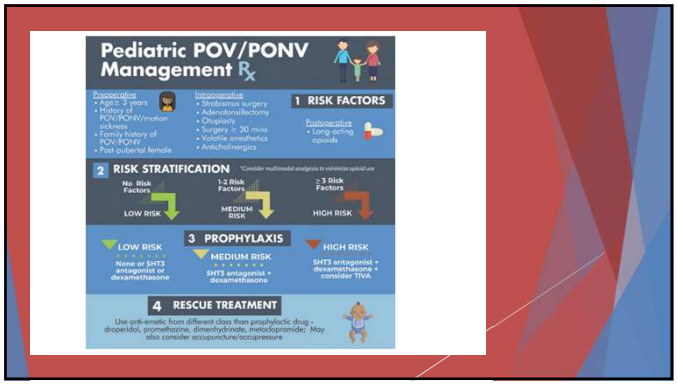

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Table 6. Antiemetic Doses for Prophylaxis of POV/PONV in Children

Drug	Dose	Evidence
Aprepitant	3 mg kg^{-1} up to 125 mg	A3[356]
Dexamethasone	150 µg kg^{-1} up to 5 mg	A1[196]
Dimenhydrinate	0.5 mg kg^{-1} up to 25 mg	A1[124]
Dolasetron	350 µg kg^{-1} up to 12.5 mg	A2[357]
Droperidol[a]	10–15 µg kg^{-1} up to 1.25 mg	A1[132]
Granisetron	40 µg kg^{-1} up to 0.6 mg	A2[358]
Ondansetron[b]	50–100 µg kg^{-1} up to 4 mg	A1[359]
Palonosetron	0.5–1.5 µg kg^{-1}	A2[360,361]
Tropisetron	0.1 mg kg^{-1} up to 2 mg	A1[157]

86

Promethazine hydrochloride (Phenergan) Pediatric Considerations

- Contraindicated for use in children less than two years of age, caution for children two years of age or older. (2004)
- FDA promethazine hydrochloride be injected by deep intramuscular administration instead of intravenous administration to reduce the risk of severe tissue injury. (2023)
- Can be administered intravenously only after dilution, as recommended, and infused through an intravenous catheter inserted in a large vein and preferably through a central venous catheter. Do not administer using intravenous catheters placed into veins in the hand or wrist.

87

- 5-Year-Old s/p T&A
- Snoring, recurrent strep
- Highly Anxious Parents
- Mask Induction, no Midaz
- Received IV acetaminophen ketorolac interoperative
- Thrashing, not making eye-contact in PACU bed

88

Emergence Delirium

89

What So Angry?

Definition

- A dissociated state of consciousness in which the child is inconsolable, irritable, uncompromising or uncooperative, typically thrashing, crying, moaning, or incoherent.

Risk Factors

- Inhaled Anesthetics, Sevoflurane
- Uncontrolled Pain
- Age 2-7 +/-
- Patient/Parental Anxiety
- Surgery type (ENT, ophthalmology)

90

Pediatric Anesthesia Emergence Delirium (PAED) score.

Point	Description of items	Not at all	Just a little	Quite a bit	Very much	extremely
1	The child makes eye contact with the caregiver	4	3	2	1	0
2	The child's actions are purposeful	4	3	2	1	0
3	The child is aware of his/her surroundings	4	3	2	1	0
4	The child is restless	0	1	2	3	4
5	The child is inconsolable	0	1	2	3	4

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How to get to…

Prophylaxis
- Preoperative
  - Positive interactions, child life
  - Midaz?
- Interoperative
  - TIVA
  - Adequate Pain control
  - Dexmedetomidine (0.3mcg/kg)
  - Propofol 1mg/kg
  - Ketamine? Magnesium?

Treatment
- Dexmedetomidine
- Propofol
- Pain Control
- Parents? Nope.
- Time!

92

Hypothermia In the Peds PACU

93

Your Patient: 2-year-old for circ repair. "Trickiest one I have ever done!"

- Prolonged prep uncovered
- Longer than expected surgical time.
- No fluid warmer
- Drapes, blankets
- Axillary Temperature probe "fell off"

94

The PACU Bair-Hugger of Shame

95

Quick Facts

- Children and neonates, compared to adults, have thinner skin, low fat content, and a greater surface area relative to weight
- The primary means that neonates produce heat is called non-shivering thermogenesis (metabolism of brown fat).
- Hypothermia is associated with coagulopathy, delayed emergence from anesthesia, cardiac arrhythmias, respiratory depression, delayed wound healing as well as prolonged PACU stays

96

- Accurate temperature monitoring (note location properly)
- Fluid warmer if indicated
- Under- or over-body warmer
- May need to warm the room if measures fail.
- Everything is worse with a neonate!

97

Hot isn't great either!

Increased metabolic rate, cardiac demand, elevate CO2.

Dehydration

Poor emergence from anesthesia

May cloud clinical diagnosis

98

Out of Hospital Pediatric Dental Anesthesia: The Safe Way(?)

99

5-year-old who failed in-office dental treatment

Poorly described history of RAD. Snoring which mother states in from allergies.

Additional Work-up Necessary? Any needed?

100

First Question: What is my setting?

101

Different Practice Models of Out of Hospital (OOH) Peds Dental Anesthesia

Stand-alone ASC

- More of a classic OR set-up
  - ASA Standard monitors, machines
  - MH Cart, LAST, advanced airways
- Variable airway mgmt- LMA, ETT, native
- Not attached or connected to hospital (if emergency calling 911)
- Staffing with pediatric specific personnel in many cases.
- Pre-operative staff, screening
- Referral base to specialists

Office-Based

- Significantly less OR resources, ASA standard monitors
- Propofol, IV sedation
- No MH (but no triggers)
- No LAST
- Airway equipment mixed
- Staffing uneven, sometimes pediatric anesthesia
- Screening can be rigorous
- Not attached or connected to hospital (if emergency calling 911)

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First Best Step- Aggressive Screening

- Conservative selection
  - ASA 2 limited
  - Elevated BMI
  - Anything that puts them at higher risk gets bumped
- Workflow- medical questionnaire before appt, screened by nurse, flagged to look at. H&P from primary and specialist.
- Hard stop: Cardiac, MH hx, CPAP etc
- Well-controlled healthy conditions only
- Staff selection
- Don't feel pressured, your job is to mitigate Risk

103

Back to our friend!

- Recommended Work-up
  - Reach out to patient's PCP for clearance or better history
  - Definitive pulmonary history with appropriate documentation from primary or pulmonologist if seeing ok. Well-controlled only
  - Sleep study if snoring/pauses and concern for OSA
    - Consider mild OSA
  - If none of this happens, cancel.

104

Toddler who died after dental procedure was hooked up to empty oxygen tank as staff muted heart alarm: lawsuit

Family awarded $95.5M after 4-year-old daughter suffered brain damage during dental appointment

Nevaeh Hall, now 10 years old, requires 24-hour medical care as she can no longer see, speak, walk or eat on her own

NEWS

Parents of toddler who died during dentist visit file wrongful death lawsuit

The parents of Daisy Lynn Torres -- the 14-month-old child who died on March 29, 2016 during a visit to a dentist at the North Austin Medical Center -- have filed a wrongful-death lawsuit against Austin Children's Dentistry, according to documents obtained by NBC Charlotte affiliate KVUE.

die after visiting dentist's office in

Sunday, January 7, 2018

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