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The Air Goes In and Out: A Review of the Updated PALICC-2 Pediatric Acute Respiratory Distress Guidelines.

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Speaker Disclosure

- We have no disclosures.

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Learning Objectives

- Review the updated Pediatric Acute Respiratory Distress Syndrome (pARDS) guidelines and any changes made from the first set of guidelines
- Discuss diagnostic criteria and recommended management strategies
- Review the strength of the recommendation
- Apply pARDS guidelines to clinical scenarios.

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Background

- Acute Respiratory Distress Syndrome (ARDS)
  - First described by Ashbaugh et al in 1967
  - 1994 American-European Consensus Conference (AECC) ARDS definition
  - 2012 Berlin ARDS definition
- Pediatric Acute Respiratory Distress Syndrome (PARDS)
  - "A heterogenous clinical syndrome, which contributes to high rates of mortality and long-term morbidities"
- Pediatric Acute Lung Injury Consensus Conference
  - 2015 first published definition for Pediatric ARDS and guidelines for management
  - 2022 updated guidelines

(Emeriaud et al., 2023), (The Pediatric Acute Lung Injury Consensus Conference Group, 2015)

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Methods

- Systematic literature review
- Stratification of recommendations utilizing GRADE methodology
- Vote to achieve consensus amongst members
- Revision of recommendations and statements

(Emeriaud et al., 2023)

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Methods

- Panelist selection criteria
  - Research relating to PARDS
  - Increasing diversity
  - International representation
- 52 content and 4 methodology experts from multiple disciplines
  - 52 physicians, 1 respiratory therapist, 1 nurse, 1 physical therapist and 1 PhD researcher

(Emeriaud et al., 2023)

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Methods

TABLE 1.
Second Pediatric Acute Lung Injury Consensus Conference Subgroups and Related Key Questions

Second PALICC Subgroups	Topic	Key Question
Section 1	Definition, incidence, and epidemiology	How should PARDS be defined, and what are the variables that best characterize the global burden of PARDS?
Section 2	Pathobiology, severity, and risk stratification	What are pediatric-specific elements of the pathobiology of PARDS, and what is the association between pathobiology and severity, and risk stratification in PARDS?
Section 3	Invasive ventilatory support	What is the effectiveness and comparative effectiveness of different ventilation strategies for children with PARDS?
Section 4	Ancillary pulmonary-specific treatments	What is the effectiveness and comparative effectiveness of pulmonary-specific ancillary treatments in children with PARDS?
Section 5	Nonpulmonary treatments	What is the effectiveness and comparative effectiveness of nonpulmonary treatments in children with PARDS?
Section 6	Monitoring	What is the role of different monitoring strategies in patients with PARDS?
Section 7	Noninvasive respiratory support	What is the effectiveness of noninvasive ventilatory support in PARDS?
Section 8	Extracorporeal support	What is the effectiveness of extracorporeal membrane oxygenation in children with PARDS?
Section 9	Morbidity and long-term outcomes	What are the morbidity and long-term outcomes in PARDS?
Section 10	Clinical informatics and data science	How can informatics, data science, and computerized decision support tools improve the diagnosis and management of PARDS?
Section 11	Implementation in RLS	How should the recommendations for the diagnosis and management of PARDS be adapted to the context of RLS?

PALICC = Pediatric Acute Lung Injury Consensus Conference, PARDS = pediatric acute respiratory distress syndrome, RLS = resource-limited settings.

(Emeriaud et al., 2023)

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Methods

TABLE 2.
Types of Recommendation and Statements Used in the Second Pediatric Acute Lung Injury Consensus Conference Guideline

Recommendation Type	Description	Method	Label
Clinical recommendations	Recommendations on clinical interventions and diagnostic tests	GRADE framework, consensus using UCLA-RAND system	Certainty of evidence, strength of recommendation
Good practice statements	Absence of direct evidence but it is obvious that implementing the statement will result in a large net positive effect	GRADE framework, consensus using UCLA-RAND system	Ungraded, good practice statements
Research statement	Inadequate evidence after a systematic review and where the panelists believed that any recommendation would be speculative	Consensus using UCLA-RAND system	Ungraded, research statement
Policy statements	Position on issues that pertain to bioethics, public health policy, healthcare finance and delivery and medical education/training	Consensus using UCLA-RAND system	Ungraded, policy statements
Definition statement	Offered in the context of updating the definition of pediatric acute respiratory distress syndrome	Consensus using UCLA-RAND system	Ungraded, definition statement

GRADE = Grading of Recommendations, Assessment, Development, and Evaluation, RAND = research and development.

(Emeriaud et al., 2023)

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"The PALICC-2 Recommendations and Statements were endorsed by the World Federation of Pediatric Intensive and Critical Care Societies on June 17, 2022."

(Emeriaud et al., 2023)

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Diagnosing PARDS

TABLE 4.
Diagnosis of Pediatric Acute Respiratory Distress Syndrome (Definition Statement 1.1; Definition Statement 1.7.1)

Age (DS 1.1)	Exclude patients with perinatal lung disease		
Timing (DS 1.2)	Within 7 d of known clinical insult		
Origin of edema (DS 1.3)	Not fully explained by cardiac failure or fluid overload		
Chest imaging (DS 1.3)	New opacities (unilateral or bilateral) consistent with acute pulmonary parenchymal disease and which are not due primarily to atelectasis or pleural effusion[a]		
Oxygenation[b] (DS 1.4.1)	IMV: OI ≥ 4 or OSI ≥ 5 NIV[c]: $PaO_2/FiO_2 \leq 300$ or $SpO_2/FiO_2 \leq 250$		
	Stratification of PARDS severity: Apply ≥ 4 hr after initial diagnosis of PARDS (DS 1.4.4).		
	IMV-PARDS: (DS 1.4.1)	Mild/moderate: OI < 16 or OSI < 12 (DS 1.4.5)	Severe: OI ≥ 16 or OSI ≥ 12 (DS 1.4.5)
	NIV-PARDS[c] (DS 1.4.2; DS 1.4.3)	Mild/moderate NIV-PARDS: $PaO_2/FiO_2 > 100$ or $SpO_2/FiO_2 > 150$	Severe NIV-PARDS: $PaO_2/FiO_2 \leq 100$ or $SpO_2/FiO_2 \leq 150$
	Special populations[d]		
Cyanotic heart disease (DS 1.6.1; DS 1.6.2)	Above criteria, with acute deterioration in oxygenation not explained by cardiac disease		
Chronic lung disease (DS 1.6.3; DS 1.6.4)	Above criteria, with acute deterioration in oxygenation from baseline		

DS = definition statement, IMV = invasive mechanical ventilation, NIV = noninvasive ventilation, OI = oxygenation index, OSI = oxygenation saturation index, PARDS = pediatric acute respiratory distress syndrome, SpO_2 = pulse oximeter oxygen saturation.
[a]Children in resource-limited settings where imaging is not available who otherwise meet PARDS criteria are considered to have possible PARDS.
[b]Oxygenation should be measured at steady state and not during transient desaturation episodes. When SpO_2 is used, ensure that $SpO_2 \leq 97\%$.
OI = mean airway pressure (MAP) (cm H_2O) × FiO_2/PaO_2 (mm Hg).
OSI = MAP (cm H_2O) × FiO_2/SpO_2.
[c]Diagnosis of PARDS on NIV (NIV-PARDS) requires full facemask interface with continuous airway positive pressure/positive end-expiratory pressure ≥ 5 cm H_2O.
[d]Stratification of PARDS severity does not apply to these populations.
Additional note: Possible PARDS and At-Risk for PARDS should not be diagnosed in children with respiratory failure solely from airways obstruction (eg, critical asthma, virus-induced bronchospasm). The corresponding definition statement numbers are indicated in parentheses.

(Emeriaud et al., 2023)

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Diagnosing possible PARDS

TABLE 5.
Diagnosis of Possible Pediatric Acute Respiratory Distress Syndrome and At-Risk for Pediatric Acute Respiratory Distress Syndrome (Definition Statement 1.5.3; Definition Statement 1.7.2; Definition Statement 11.2)

Age	Exclude patients with perinatal lung disease
Timing	Within 7 d of known clinical insult
Origin of edema	Not fully explained by cardiac failure or fluid overload
Chest imaging (DS 1.5.2)	New opacities (unilateral or bilateral) consistent with acute pulmonary parenchymal disease and which are not due primarily to atelectasis or effusion[a]
Oxygenation[b] threshold to diagnose possible PARDS for children on nasal respiratory support (DS 1.5.1)	
	Nasal continuous airway positive pressure/bilevel positive airway pressure or high-flow nasal cannula (> 1.5 L/kg/min or > 30 L/min): $PaO_2/FiO_2 \leq 300$ or $SpO_2/FiO_2 \leq 250$
Oxygenation[b] threshold to diagnose at-risk for PARDS	
	Any interface: Oxygen supplementation[c] to maintain $SpO_2 \geq 88\%$ but not meeting definition for PARDS or possible PARDS
Special populations	
Cyanotic heart disease	Above criteria, with acute deterioration in oxygenation not explained by cardiac disease
Chronic lung disease	Above criteria, with acute deterioration in oxygenation from baseline

DS = definition statement, PARDS = pediatric acute respiratory distress syndrome, SpO_2 = pulse oximeter oxygen saturation.
[a]Children in resource-limited environments where imaging is not available who otherwise meet possible PARDS criteria are considered to have possible PARDS.
[b]Oxygenation should be measured at steady state and not during transient desaturation episodes. When SpO_2 is used, ensure that $SpO_2 \leq 97\%$.
[c]Children on nasal noninvasive ventilation (NIV) or high-flow nasal cannula are not eligible for PARDS but are considered to have possible PARDS when this oxygenation threshold is met.
[d]Oxygen supplementation is defined as $FiO_2 > 21\%$ on invasive mechanical ventilation, or $FiO_2 > 21\%$ on NIV, or "oxygen flow" from a mask or cannula that exceeds these age-specific thresholds: ≥ 2 L/min (age < 1 y); ≥ 4 L/min (age 1–5 y); ≥ 6 L/min (age 6–10 y); or ≥ 8 L/min (age > 10 y). For children on a mask or cannula, oxygen flow calculated as FiO_2 × flow rate (L/min) (eg, 6 L/min flow at 0.35 FiO_2 = 2.1 L/min).
Additional note: Possible PARDS and at-risk for PARDS should not be diagnosed in children with respiratory failure solely from airway obstruction (eg, critical asthma, virus-induced bronchospasm). The corresponding definition statement numbers are indicated in parentheses.

(Emeriaud et al., 2023)

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Diagnosis of PARDS in chronic cardiorespiratory disease

- Cyanotic congenital heart disease
  - Fulfill PARDS criteria AND have acute deterioration in oxygenation from baseline NOT fully explained by underlying heart disease
- Chronic lung disease
  - Fulfill PARDS criteria AND have acute deterioration in oxygenation from baseline that meets oxygenation criteria for PARDS.

(Emeriaud et al., 2023)

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Risk stratification

Oxygenation Index (OI)	Oxygenation Saturation Index (OSI)
[MAP (FiO2 ÷ PaO2)] x 100	[MAP (FiO2 ÷ SpO2)] x 100
Mild/moderate OI < 16	Mild/moderate OSI < 12
Severe OI ≥ 16	Severe OSI ≥ 12

*Meet PARDS criteria with OI ≥ 4 or OSI ≥ 5

(Emeriaud et al., 2023)

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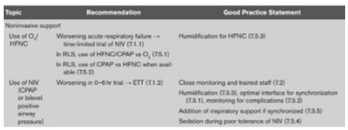
Managing PARDS

- Non-invasive ventilation
  - Continuous versus bilevel positive airway pressure
  - Allow for 0-6 hour trial period, if no improvement consider tracheal intubation



Topic	Recommendation	Good Practice Statement
Noninvasive support		
Use of O_2/HFNC	Worsening acute respiratory failure → time-limited trial of NIV (7.1.1) In RLS, use of HFNC/CPAP vs O_2 (7.5.1) In RLS, use of CPAP vs HFNC when available (7.5.2)	Humidification for HFNC (7.3.3)
Use of NIV (CPAP or bilevel positive airway pressure)	Worsening in 0–6-hr trial → ETT (7.1.2)	Close monitoring and trained staff (7.2) Humidification (7.3.3), optimal interface for synchronization (7.3.1), monitoring for complications (7.3.2) Addition of inspiratory support if synchronized (7.3.5) Sedation during poor tolerance of NIV (7.3.4)

(Emeriaud et al., 2023)

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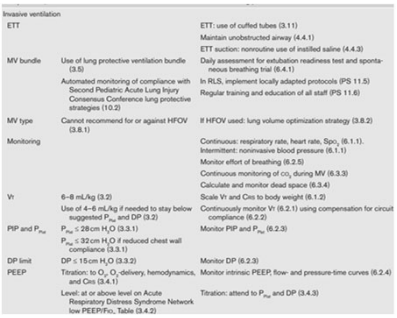
Managing PARDS

- Invasive ventilation
  - Cuffed ETT
  - Lung protective ventilation bundle
  - Ventilator types
- Monitoring parameters
  - CR and SpO2
  - EtCO2
  - Dead space



Invasive ventilation		
ETT		ETT: use of cuffed tubes (3.1.1) Maintain unobstructed airway (4.4.1) ETT suction: nonroutine use of instilled saline (4.4.3)
MV bundle	Use of lung protective ventilation bundle (3.5)	Daily assessment for extubation readiness test and spontaneous breathing trial (6.4.1)
	Automated monitoring of compliance with Second Pediatric Acute Lung Injury Consensus Conference lung protective strategies (10.2)	In RLS, implement locally adapted protocols (PS 11.5) Regular training and education of all staff (PS 11.6)
MV type	Cannot recommend for or against HFOV (3.8.1)	If HFOV used: lung volume optimization strategy (3.8.2)
Monitoring		Continuous: respiratory rate, heart rate, Spo_2 (6.1.1). Intermittent: noninvasive blood pressure (6.1.1) Monitor effort of breathing (6.2.5) Continuous monitoring of co_2 during MV (6.3.3) Calculate and monitor dead space (6.3.4)
Vt	6–8 mL/kg (3.2)	Scale Vt and Cins to body weight (6.1.2)
	Use of 4–6 mL/kg if needed to stay below suggested P_{plat} and DP (3.2)	Continuously monitor Vt (6.2.1) using compensation for circuit compliance (6.2.2)
PIP and P_{mw}	$P_{plat} \leq 28$ cm H_2O (3.3.1)	Monitor PIP and P_{mw} (6.2.3)
	$P_{plat} \leq 32$ cm H_2O if reduced chest wall compliance (3.3.1)	
DP limit	DP ≤ 15 cm H_2O (3.3.2)	Monitor DP (6.2.3)
PEEP	Titration: to O_2, O_2 delivery, hemodynamics, and Cins (3.4.1)	Monitor intrinsic PEEP, flow- and pressure-time curves (6.2.4)
	Level: at or above level on Acute Respiratory Distress Syndrome Network low PEEP/Fio_2 Table (3.4.2)	Titration: attend to P_{mw} and DP (3.4.3)

(Emeriaud et al., 2023)

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Managing PARDS

- High-frequency ventilation
  - No recommendation can be made as to whether HFOV should be used as opposed to conventional ventilation
  - *Conditional CR, low certainty of evidence, 90% agreement*
- HFOV may be considered in patients who have failed to meet ventilation goals with conventional modes of ventilation

(Emeriaud et al., 2023)

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Monitoring

- Physiologic tidal volumes (6-8 mL/kg)
  - Allow for lower tidal volumes (< 6 mL/kg) to minimize plateau and driving pressure.
  - *Conditional CR, very low certainty of evidence, 98% agreement*
- Plateau pressure ≤ 28 cmH20 or ≤ 32 cmH20 if reduced chest wall compliance
  - *Conditional CR, very low certainty of evidence, 92% agreement*
- Permissive hypercapnia, target pH > 7.2
  - Recommend against the routine use of bicarbonate supplementation
  - Exceptions: increased ICP, pulmonary hypertension, hemodynamic instability
  - *Conditional CR, very low certainty of evidence, 100% agreement*

(Emeriaud et al., 2023)

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Monitoring

- Titrate PEEP to maintain oxygenation, oxygen delivery, hemodynamics and compliance.
  - *Conditional CR, very low certainty of evidence, 96% agreement*
- Maintain PEEP at or above the lower PEEP/higher FiO2 table per ARDS Network protocol
  - *Strong CR, moderate certainty of evidence, 96% agreement*
- Target SpO2 92-97% for mild/moderate PARDS
  - *Conditional CR, low certainty of evidence, 88% agreement)*
- May allow for SpO2 < 92% in severe ARDS if PEEP optimized
  - *Conditional CR, low certainty of evidence, 88% agreement*
- **Good practice statement**
  - **"Prolonged exposure to hypoxemic (<88%) or high (>97%) SpO2 targets should be avoided while on oxygen supplementation" *(GPS, 88% agreement)***

(Emeriaud et al., 2023)

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ARDS Network protocol for PEEP/FiO2

- **Supplemental Table 1.** Lower PEEP/higher FiO2 table, adapted from the ARDS Network protocol

FiO_2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
PEEP cmH_2O	5	6-8	8-10	10	10-14	14	14-18	18-24

(Emeriaud et al., 2023)

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Ancillary Treatment

- Inhaled nitric oxide
  - Recommend against the routine use of iNO compared with selective use in PARDS patients
  - * May benefit certain populations (pulmonary hypertension)
  - * May be used as a bridge to ECMO
  - *Conditional CR, low certainty of evidence, 98% agreement*
- Prone positioning
  - May be considered in patients with refractory hypoxemia
  - *Conditional CR, low certainty of evidence, 94% agreement*

(Emeriaud et al., 2023)

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Ancillary Treatments

- Surfactant
  - Recommend against the routine use of surfactant compared with selective use in certain populations
  - *Conditional CR, low certainty of evidence, 100% agreement*
- Corticosteroids
  - Recommend against the use of routine corticosteroids compared with selective use in PARDS patients

  * May be of benefit in those with COVID-19 infection
  - *Conditional CR, low certainty of evidence, 96% agreement*

(Emeriaud et al., 2023)

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Airway clearance and suctioning

- Maintain an unobstructed airway *(GPS, 98% agreement)*
  - Consider risk of derecruitment
  - Cannot recommend open versus closed suctioning
  - Recommend against the use of routine isotonic saline instillation prior to suctioning *(GPS, 94% agreement)*
- Airway clearance
  - No specific airway clearance regimen can be recommended *(RS, 96% agreement)*

(Emeriaud et al., 2023)

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Non-pulmonary Treatment

Pain, Agitation, Neuromuscular Blockade, and Delirium in Critically Ill Pediatric Patients With Consideration of the ICU Environment and Early Mobility		
Approach		Nonpharmacological multicomponent approaches (5.2.2; 5.7.1)
Assessment		Use of scales (5.1.1) Daily assessment of activity and mobility goals (5.7.2) Rehabilitation evaluation by 72hr (5.7.3) Daily assessment for delirium (5.2.1) If treated ≥ 5 d assess for iatrogenic withdrawal syndrome (5.1.4)
Sedation		Titrate drugs for minimal, yet effective dose (5.1.2) Monitor and wean with goal-directed protocol (5.1.3)
NMBA	Use of NMBA, if protective ventilation is not achieved with sedation alone (5.3.1)	Monitor and titrate to goal-established (5.3.2)
Fluids	Optimize while preventing overload (5.5)	Monitor cumulative fluid balance (6.6.2)
Nutrition	Early start (< 72hr) EN (5.4.1) Protein ≥ 1.5 g/kg/d (5.4.4)	Nutrition plan (5.4.2) EN monitoring with goal-directed protocol (5.4.3)
Blood	No transfusion of pRBC for hemoglobin concentration ≥ 7 g/dL (5.6.2)	Use of pRBC for hemoglobin concentration < 5 g/dL (5.6.1)

(Emeriaud et al., 2023)

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Non-pulmonary Treatment

- Sedation
  - Use of valid and reliable assessment scales for pain, sedation, withdrawal, and delirium *(GPS, 100% agreement)*
  - Minimal yet effective sedation titrated to achieve adequate mechanical ventilation *(GPS, 96% agreement)*
  - Monitoring, titrating, and weaning should be driven by goal-directed protocol *(GPS, 96% agreement)*
- Neuromuscular blockade
  - Minimal yet effective neuromuscular blockade used in conjunction with sedation if adequate mechanical ventilation cannot be achieved with sedation alone *(Conditional CR, very low certainty of evidence, 98% agreement)*

(Emeriaud et al., 2023)

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Delirium and Sleep

- Assess daily for delirium using a validated pediatric delirium screening tool *(GPS, 94% agreement).*
- Use of non-pharmacologic interventions as first-line interventions to prevent and treat delirium *(GPS, 90% agreement)*
- **Research statement: Future studies are needed to evaluate the role of antipsychotic medications and melatonin in the treatment of delirium.**

(Emeriaud et al., 2023)

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Non-pulmonary Treatment

- Nutrition
  - Early initiation of enteral nutrition (< 72 hours) over parenteral nutrition or delayed enteral nutrition *(Conditional CR, very low certainty of evidence, 92% agreement)*
- Fluid management
  - Daily fluid goal established by interprofessional team, prevent fluid overload *(Conditional CR, low certainty of evidence, 98% agreement)*
- Transfusion
  - Critically ill patients with respiratory failure and hemoglobin < 5 g/dL should receive packed red blood cells *(GPS, 96% agreement)*

(Emeriaud et al., 2023)

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Extracorporeal Support and Severe PARDS

- Patients with a potentially reversible cause of severe PARDS should be evaluated for extracorporeal membrane oxygenation when lung protective strategies result in inadequate gas exchange *(Conditional CR, very low certainty of evidence, 96% agreement)*

(Emeriaud et al., 2023)

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Morbidity and Long-Term Outcomes

- Primary care providers should be advised to screen for post-ICU morbidities within 3 months of discharge *(GPS, 90% agreement)*
- Patients with PARDS should be screened for pulmonary function abnormalities within the first 3 months following discharge *(GPS, 90% agreement)*
- Evaluation of quality of life, physical, neurocognitive, emotional, family, and social function should be evaluated within 3 months of discharge *(GPS, 100% agreement)*

(Emeriaud et al., 2023)

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Case Presentation

- 3 yo F, admitted for acute hypoxic respiratory failure
- 3 day history of fever, increased WOB, fatigue, emesis (NBNB), decreased saturations at home (low 90s), and concern for yellowing of skin
- Medical history: Trisomy 13, severe persistent asthma, bronchomalacia, intestinal malrotation s/p Ladds, G-tube dependent, VUR with recurrent multi-drug resistant UTIs, neurogenic bladder/bowel, VSD, ASD, and seizure disorder

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Case Presentation: ED arrival

- 36.9*C, 109/58, HR 135, RR 24, SpO2 85% in room air
- Pale color, retractions throughout, abdominal distension

Treatment initiated:

- Oxygen and breathing tx
- Imaging, lab work
- Antibiotics
- Fluid resuscitation

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Case Presentation: Initial findings

- Adenovirus and human metapneumovirus
- pH 7.32, CO2 44, PO2 43, HCO3 23, Lactate 1.3, Glucose 102
- Blood and urine CX pending
- CRP: 6.4, Procal 0.23
- UA: 1.013, clear, yellow, - leukocyte esterase, - nitrites, - glucose, - ketones

	11.7		
7.7		152	
	35.5		

138	107	18	
3.2	22	0.45	105

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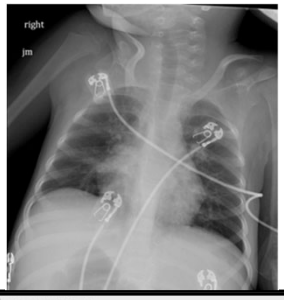
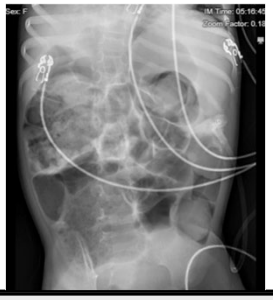
Case Presentation: Imaging





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PARDS or not PARDS

TABLE 4.
Diagnosis of Pediatric Acute Respiratory Distress Syndrome (Definition Statement 1.1; Definition Statement 1.7.1)

✓	**Age** (DS 1.1)	Exclude patients with perinatal lung disease
✓	**Timing** (DS 1.2)	Within 7 d of known clinical insult
	Origin of edema (DS 1.3)	Not fully explained by cardiac failure or fluid overload
✓	**Chest imaging** (DS 1.3)	New opacities (unilateral or bilateral) consistent with acute pulmonary parenchymal disease and which are not due primarily to atelectasis or pleural effusion[a]
✓	**Oxygenation**[b] (DS 1.4.1)	IMV: OI ≥ 4 or OSI ≥ 5 NIV[c]: $Pao_2/Fio_2 \leq 300$ or $Spo_2/Fio_2 \leq 250$
		Stratification of PARDS severity: Apply ≥ 4 hr after initial diagnosis of PARDS (DS 1.4.4)
	IMV-PARDS: (DS 1.4.1)	Mild/moderate: OI < 16 or OSI < 12 (DS 1.4.5) / Severe: OI ≥ 16 or OSI ≥ 12 (DS 1.4.5)
	NIV-PARDS[c] (DS 1.4.2; DS 1.4.3)	Mild/moderate NIV-PARDS: $Pao_2/Fio_2 > 100$ or $Spo_2/Fio_2 > 150$ / Severe NIV-PARDS: $Pao_2/Fio_2 \leq 100$ or $Spo_2/Fio_2 \leq 150$
		Special populations[d]
	Cyanotic heart disease (DS 1.6.1; DS 1.6.2)	Above criteria, with acute deterioration in oxygenation not explained by cardiac disease
	Chronic lung disease (DS 1.6.3; DS 1.6.4)	Above criteria, with acute deterioration in oxygenation from baseline

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Case Presentation: ICU Admission Day 1

- Resp:
  - NIPPV 14/6, FiO2 35%
  - Airway clearance
- Neuro:
  - Baseline anti-epileptics: cannabidiol, clobazam, topiramate
- GI:
  - G-tube to dependent drainage
- GU:
  - Baseline irrigation
- ID/IMMUNE:
  - Recurrent UTIs
  - Broad spectrum antibiotics

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Case Presentation: ICU Admission Day 1

- VS:
  - 36-39.5*
  - HR 120-150 bpm
  - RR 25-45 bpm
  - BP WNL
  - Oxygen saturations 92-97%
- Increased WOB
- Prolonged recovery, FiO2 >75% x1 hour
- CXR
- Gas
- Fluid balance

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Case Presentation: ICU Admission Day 1

Topic	Recommendation	Good Practice Statement
Noninvasive support		
Use of O_2/HFNC	Worsening acute respiratory failure → time-limited trial of NIV (7.1.1)	Humidification for HFNC (7.3.3)
	In RLS, use of HFNC/CPAP vs O_2 (7.5.1)	
	In RLS, use of CPAP vs HFNC when available (7.5.2)	
Use of NIV (CPAP or bilevel positive airway pressure)	Worsening in 0–6 hr trial → ETT (7.1.2)	✓Close monitoring and trained staff (7.2) ✓Humidification (7.3.3), optimal interface for synchronization (7.3.1), monitoring for complications (7.3.2) ✓Addition of inspiratory support if synchronized (7.3.5) ✓Sedation during poor tolerance of NIV (7.3.4)

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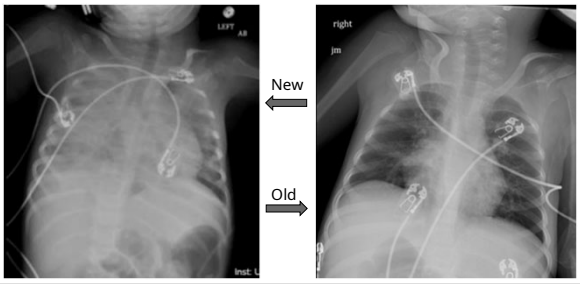
Case Presentation: ICU Admission



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Case Presentation: ICU Admission

- Cuffed ETT
- CMAC
- Rescue medication
- Rescue volume
- Time and patience

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PARDS or not PARDS

0630: *SF: 114*
7.18/41/41/14 (1.1)

0930: *OI: 44*
7.02/ 90/56/22 (1.1)

1030: *OI: 40*
7.2/53/61/20 (0.7)

1230: *OSI: 21*
7.15/61/39/20 (1.1)

1330: *OI: 28, DS: 2.7*
7.31/40/61/19 (0.9)

TABLE 4.
Diagnosis of Pediatric Acute Respiratory Distress Syndrome (Definition Statement 1.1; Definition Statement 1.7.1)

✓	**Age** (DS 1.1)	Exclude patients with perinatal lung disease
✓	**Timing** (DS 1.2)	Within 7 d of known clinical insult
✓	**Origin of edema** (DS 1.3)	Not fully explained by cardiac failure or fluid overload
✓	**Chest imaging** (DS 1.3)	New opacities (unilateral or bilateral) consistent with acute pulmonary parenchymal disease and which are not due primarily to atelectasis or pleural effusion[a]
✓	**Oxygenation**[b] (DS 1.4.1)	IMV: OI ≥ 4 or OSI ≥ 5 NIV: $Pao_2/Fio_2 \leq 300$ or $Spo_2/Fio_2 \leq 250$
		Stratification of PARDS severity: Apply ≤ 4 hr after initial diagnosis of PARDS (DS 1.4.4)
	IMV-PARDS: (DS 1.4.1)	Mild/moderate: OI < 16 or OSI < 12 (DS 1.4.5) / Severe: OI ≥ 16 or OSI ≥ 12 (DS 1.4.5)
	NIV-PARDS[c] (DS 1.4.2; DS 1.4.3)	Mild/moderate NIV-PARDS: $Pao_2/Fio_2 > 100$ or $Spo_2/Fio_2 > 150$ / Severe NIV-PARDS: $Pao_2/Fio_2 \leq 100$ or $Spo_2/Fio_2 \leq 150$
		Special populations[d]
	Cyanotic heart disease (DS 1.6.1; DS 1.6.2)	Above criteria, with acute deterioration in oxygenation not explained by cardiac disease
	Chronic lung disease (DS 1.6.3; DS 1.6.4)	Above criteria, with acute deterioration in oxygenation from baseline

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Case Presentation: Management Day 1

RESP:

- PC/AC:
  - Cuffed ETT
  - PIP 34, PEEP 14, RR30
- Goal:
  - TV: 4-6 mL/kg
  - pH >7.2 with permissive hypercapnia
  - SpO2 >88%
- HFOV:
  - MAP 25
  - Delta 55
  - Hertz 10
  - FiO2 100%
- Inhaled nitric oxide
  - 20 ppm
- Prone positioning

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PROSPECT: The PRone and OScillation Pediatric Clinical Trial (*PROSpect*)

- NIH, international, randomized
- Severe PARDs
  - Randomization stratified by age group and direct/indirect lung injury
  - Outcomes: Ventilator free days, Organ failure free days
  - *Enrolled within 96 hours of intubation*
  - ***Need 2 sequential OI/OSI (4hr ± 2h apart) c/w severe PARDS + B/L infiltrates*

CMV & Supine	CMV & Prone
HFOV & Supine	HFOV & Prone

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Case Presentation: Management Day 1

CV:

- Epinephrine and norepinephrine

Neuro:

- Continue home regimen

FEN/GI:

- NPO/Tube feeds

GU:

- Urinary catheter placement following retention

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Case Presentation: Respiratory Progression

1730: *OI: 10.9*
7.29/44/55/20 (1.0)

2030: *OI: 11*
7.42/29/47/19 (1.2)

2300: *OI: 6.5*
7.14/67/85/22 (0.6)

0000: *OI: 5.0*
7.24/52/82/21 (0.6)

TABLE 4.
Diagnosis of Pediatric Acute Respiratory Distress Syndrome (Definition Statement 1.1; Definition Statement 1.7.1)

Age (DS 1.1)	Exclude patients with perinatal lung disease
Timing (DS 1.2)	Within 7 d of known clinical insult
Origin of edema (DS 1.3)	Not fully explained by cardiac failure or fluid overload
Chest imaging (DS 1.3)	New opacities (unilateral or bilateral) consistent with acute pulmonary parenchymal disease and which are not due primarily to atelectasis or pleural effusion[a]
Oxygenation[b] (DS 1.4.1)	IMV: OI ≥ 4 or OSI ≥ 5 NIV: $Pao_2/Fio_2 \leq 300$ or $Spo_2/Fio_2 \leq 250$
	Stratification of PARDS severity (apply at the earliest diagnosis of PARDS (DS 1.4.4)
	IMV-PARDS: (DS 1.4.1) Mild/moderate: OI < 16 or OSI < 12 (DS 1.4.5) Severe: OI ≥ 16 or OSI ≥ 12 (DS 1.4.5)
	NIV-PARDS[c] (DS 1.4.2; DS 1.4.3) Mild/moderate NIV-PARDS: $Pao_2/Fio_2 > 100$ or $Spo_2/Fio_2 > 150$ Severe NIV-PARDS: $Pao_2/Fio_2 \leq 100$ or $Spo_2/Fio_2 \leq 150$
	Special populations[d]
Cyanotic heart disease (DS 1.6.1; DS 1.6.2)	Above criteria, with acute deterioration in oxygenation not explained by cardiac disease
Chronic lung disease (DS 1.6.3; DS 1.6.4)	Above criteria, with acute deterioration in oxygenation from baseline

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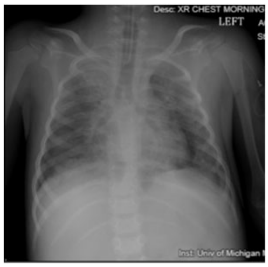
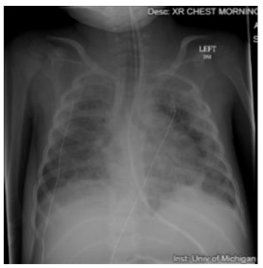
Case Presentation: Respiratory Progression



24 H

48 H



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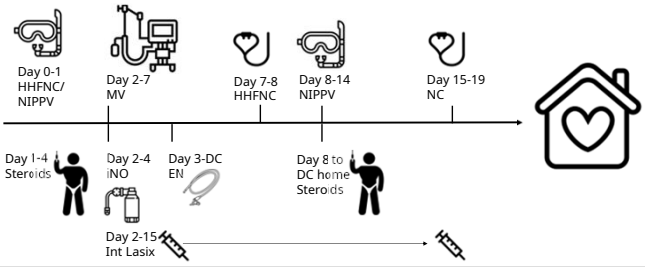
Case Presentation: Respiratory Progression



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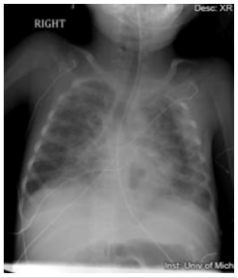
Case Presentation: Respiratory Progression



6D

After 6 days of intubation

- iNO
- HFOV
- NIPPV
- Prone
- Steroids
- Antibiotics
- Fluid resuscitation
- Respiratory treatments

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Thank you

Please do not hesitate to contact with any questions

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+ 3 new NPs, and 4 new NP babies!

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