

Clinical Guidance

Paediatric Critical Care: Acute Respiratory Distress Syndrome (ARDS)

Summary

Guidance for the management of patients with Acute Respiratory Distress Syndrome.

Document Detail		
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Keywords	ARDS, acute respiratory distress syndrome, ventilation, respiratory, hypoxia, ECMO, PICU, child, Evelina	
Relevant external law, regulation, standards	This clinical guideline has been produced by the South Thames Retrieval Service (STRS) at Evelina London for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children. This guideline represents the views of STRS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.	
Date	Change details, since approval	Approved
September 2022	Update on PALICC guidance about diagnosing ARDS. Initial management steps, including emergency resuscitation. Consideration of pulmonary embolus. Updated advice on ventilation strategy, recruitment measures, VV ECMO with attached guidance.	October 2022
February 2026	Updated content based on PALICC-2 guidance (diagnostic criteria, SpO ₂ and ventilation targets, nutrition). References updated.	

Glossary:

OI: oxygenation index, OSI: Oxygen Saturation Index, SIADH: syndrome of inappropriate ADH, TAPVD: total anomalous pulmonary venous drainage, PHT: Pulmonary Hypertension, RV: right ventricle, iNO: inhaled nitric oxide, Ti: inspiratory time, V-Q: ventilation-perfusion, CTPA: CT pulmonary angiogram, HFOV: high frequency oscillatory ventilation

Diagnostic criteria

- Clinical syndrome of hypoxaemia associated with pulmonary infiltrates secondary to oedema (Table)¹.
- Severity depends on degree of hypoxaemia assessed by **OI** (PaO₂) or **OSI** (SpO₂) if no arterial gas in patients *invasively ventilated* OR **PaO₂/FiO₂** or **SpO₂/FiO₂** in patients on *non-invasive ventilation* (full face mask with CPAP/PEEP ≥ 5 cmH₂O)
- Internationally, PARDS affects 3% of overall PICU patients and 6% of those mechanically ventilated

Mortality >30% in severe PARDS²

Age	Exclude patients with perinatal lung disease	
Timing	Within 7 days of a known clinical insult	
Origin of oedema	Not fully explained by cardiac failure or fluid overload	
Chest imaging	New opacities (uni- or bilateral) consistent with acute pulmonary parenchymal disease and which are not due primarily to atelectasis or pleural effusion	
Oxygenation	IMV*: OI [†] ≥ 4 or OSI [†] ≥ 5 NIV*: PaO ₂ /FiO ₂ ≤ 300 or SpO ₂ /FiO ₂ ≤ 250	
Stratification of severity (apply ≥ 4h after initial diagnosis of PARDS)		
	Mild/moderate	Severe
IMV-PARDS	OI < 16 or OSI < 12	OI ≥ 16 or OSI ≥ 12
NIV-PARDS	PaO ₂ /FiO ₂ > 100 or SpO ₂ /FiO ₂ > 150	PaO ₂ /FiO ₂ ≤ 100 or SpO ₂ /FiO ₂ ≤ 150
Special populations (stratification of severity not applicable)		
Cyanotic heart disease	Above criteria with acute deterioration in oxygenation not explained by cardiac disease	
Chronic lung disease	Above criteria with acute deterioration in baseline oxygenation from baseline	

*IMV: invasive mechanical ventilation; *NIV: non-invasive ventilation; †OI: (FiO₂ in % x mean airway pressure) / PaO₂ in mmHg; †OSI: (FiO₂ in % x mean airway pressure) / SpO₂

Risk Factors²:

- Pneumonia (incidence 63%, mortality 12%)
- [Sepsis](#) (incidence 19%, mortality 30%)
- Aspiration (incidence 8%, mortality 22%)

Baseline investigations

- Blood gas, FBC, CRP, procalcitonin, biochemistry, coagulation, blood culture, group & save
- Respiratory secretion (ideally BAL): MC&S, viral panel
- CXR

Additional investigations

- Bedside US: discriminate ARDS vs effusions
- Echo: ventricular function; exclude CHD (e.g. ASD to explain hypoxia or TAPVD, pulmonary hypertension (PHT))

Management:**Airway & Breathing**

- Cuffed ETT of age-appropriate size
- Anticipate cardiorespiratory collapse during induction of anaesthesia – difficult to match negative pressure self-ventilation with positive pressure mechanical ventilation
- Use Ayre's T-piece to provide PEEP until ETT placed
- Use ketamine/fentanyl/rocuronium for induction

Cardiovascular

- Anticipate CVS instability: fluid boluses & adrenaline infusion
- Pre-load may be affected by high-pressure ventilation and in sepsis – low threshold for inotropic support
- Place arterial line

Neurology

- Ensure adequate sedation – IV morphine infusion & clonidine enteral or IV infusion recommended
- Muscle relaxation helpful in severe ARDS/ high pressure ventilation to optimise synchronicity

Renal/Fluids

- High likelihood of SIADH
- Pulmonary oedema will worsen ventilation status
- Aim for negative balance – fluid-restriction
- Early initiation of enteral nutrition when feasible¹

Sepsis

- Presume infection – broad spectrum antibiotics initially
- Fluid resuscitate +/- inotropic support as needed

Consider pulmonary embolus (especially in COVID-19 ARDS):

- High suspicion if hypoxia out of keeping with clinical state
- Perform echocardiogram (right heart strain) +/- CTPA¹⁵

“Open lung” ventilation strategy for PARDS^{1,3,4}

- Take care to exclude dynamic hyperinflation (obstructive airways disease) prior to initiating this strategy - if hyperinflation: use [Asthma/Bronchiolitis](#) guidance⁵

Targets:

- SpO₂
- Mild/moderate PARDS 92-97%
- Severe PARDS 88-92% (after optimising PEEP) (>90% if pulmonary hypertension)
- pH ≥ 7.2 (pH ≥ 7.3 if pulmonary hypertension)
- Appropriately sized cuffed ETT for ventilation in PARDS

Mode:

- Conventional ventilation preferred to HFOV⁶
 - HFOV for consideration if respiratory ECMO not available AND peak plateau pressure >28 cmH₂O
- Parameters:**
- Aim for adequate ventilation with minimal ventilator-induced lung injury (VILI)
 - Target low tidal volumes 4-6 mL/kg¹ to stay below plateau and driving pressure limits
 - Aim inspiratory plateau pressure ≤ 28cmH₂O (cap at 32 cmH₂O)¹
 - Be mindful of driving pressure – limit to 15 cmH₂O¹ (plateau – PEEP), independently associated with length of ventilation & VILI¹³
 - PEEP titrated to oxygenation, haemodynamics and compliance¹

FiO ₂	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
PEEP cmH ₂ O	5	6-8	8-10	10	10-14	14	14-18	18-24

- Increase Ti to 1–1.2s depending on set rate¹
- iNO if PHT or RV dysfunction and trial this if hypoxia refractory to above measures

Monitoring:

- SpO₂, ETCO₂, arterial gases, OI trend
- Regular CXR; CT chest not routinely indicated

Ancillary therapy

- Consider prone positioning in patient with severe hypoxemia as it might help recruit atelectatic lung and improve V-Q mismatch – better ventilation & oxygenation, less over-distension in non-dependent lung regions¹⁴
- Suctioning to keep the ETT clear is essential, but caution to minimise the risk of derecruitment – consider inline vs open¹
- There is no current evidence to support routine physiotherapy or use of surfactant/ corticosteroid treatment in PARDS. In severe cases, these therapies are usually trialled/ considered¹

Extra-corporeal membrane oxygenation (ECMO)

- Initiate ECMO discussion if OI ≥ 25
- ECMO indicated if OI ≥ 40, disease process is reversible and no contraindications¹⁰
- Optimal time to initiate is unknown¹¹
- Worse outcomes if:
 - pH < 7.2, cardiac arrest prior to ECMO¹², >7 days since onset of disease¹⁰
- Standard of care is veno-venous ECMO¹⁰ – ELCH guidance:
 - [VV ECMO](#)
 - [ECMO Goals](#)

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