Clinical Guidance

Paediatric Critical Care: Acute Respiratory Distress Syndrome (ARDS)

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

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Change History

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Glossary:
OI: oxygenation index, OSI Oxygen Saturation Index
TAPVD: total anomalous pulmonary venous drainage,
FRC: functional residual capacity
Paediatric Critical Care

Acute Respiratory Distress Syndrome (ARDS)

Diagnostic criteria
Paediatric ARDS is the clinical syndrome of hypoxaemia associated with pulmonary infiltrates secondary to oedema (Table). OI (PaO₂) used to classify severity, but use OSI (SpO₂) if no arterial gas.

<table>
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<th>Age</th>
<th>Exclude patients with perinatal lung disease</th>
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<tbody>
<tr>
<td>Timing</td>
<td>Within 7 days of known insult</td>
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<tr>
<td>Origin of oedema</td>
<td>Respiratory failure not fully explained by cardiac failure of fluid overload</td>
</tr>
<tr>
<td>Chest imaging</td>
<td>Chest imaging findings of new infiltrate(s) consistent with acute pulmonary parenchymal disease</td>
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<tr>
<td>Severity</td>
<td>Mild</td>
</tr>
<tr>
<td>OI</td>
<td>4–8</td>
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<tr>
<td>OSI&quot;</td>
<td>5–7.5</td>
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Special populations: chronic lung disease and/or left ventricular dysfunction

*Mortality is high: 10-12% (mild to moderate) 33% (severe)*

Aetiology and investigations
Treat with broad-spectrum antibiotics (allergies)

Major causes of paediatric ARDS:
- Pneumonia (63%, mortality 12%)
- Sepsis (19%, mortality 30%)
- Aspiration (8%, mortality 22%)

Baseline investigations:
- FBC, CRP, procalcitonin, biochemistry, coagulation, blood culture, BAL, Group and save
- Daily CXR

Consider:
- USS: discriminate between ARDS and effusions
- Echocardiogram: ventricular function; structural anomalies (e.g. TAPVD), concerns of pulmonary hypertension (PH)

Aetiological therapy
- Prone positioning for 18/24 h
- No evidence to support: lung recruitment manoeuvres, routine suctioning of ETT, administration of surfactant and/or steroids; or chest physiotherapy

Non-pulmonary treatment
Determine and treat aetiology:

Sedation: review at least twice daily
- IV morphine and IV/PO clonidine; wean slowly
- Muscle relaxation beneficial in severe ARDS

Fluids:
- standard protocol, aim negative balance

Sepsis:
- If hypotensive, add inotropes early and titrate fluid boluses carefully

Extra-corpooreal membranous oxygenation
- ECMO discussion if OI ≥25
- ECMO indicated if OI ≥40, disease process is reversible and no contraindications
- Optimal time to initiate is unknown. Worse outcome if: pH<7.2, cardiac arrest prior to ECMO, or >7 days since onset of disease
- Standard of care is veno-venous ECMO
- Counsel parents (stroke, bleeding, infection)

**“Open lung” ventilation strategy for ARDS**

If dynamic hyperinflation⁵ do not use this strategy

**Targets:**
- SpO₂ ≥85% (>90% if pulmonary hypertension hypertension) pH ≥7.2 (pH ≥7.3 if PH)

**Mode:**
- Conventional ventilation preferred to HFOV
- Volumes: 3–6 ml/kg V₁

**Pressures:**
- Peak plateau pressure limited to 32 cmH₂O
- PEEP: 10–14 cmH₂O (care: decreased preload)
- Increase Ti to 1–1.2s depending on set rate
- Give iNO if documented PH or RV dysfunction

**Monitoring:**
- SpO₂, ETCO₂, arterial gases (place line), OI trend
- Regular CXR; CT chest not routinely indicated

Exclude dynamic hyperinflation (gas trapping)⁵
- End-expiratory volume exceeds FRC leading to barotrauma and haemodynamic compromise (Figure). Typically in asthma or bronchiolitis.

Idenidentified by:
- Upward slope in ETCO₂ at end expiration
- Flow time loops for end expiratory flow
- Inspiratory hold to measure peak to plateau pressures

If hyperinflation: use asthma/bronchiolitis strategy

References:
6. Ferguson et al. (2013) NEJM 368: 795
7. Beitler et al. (2014) ICM 403: 332