ARDS Management Algorithm

- Confirm ARDS, Diagnose and Treat Cause
- Assess whether 1<sup>st</sup> or 2<sup>nd</sup> ARDS (see Box 3)
- Set TV 4-6ml/kg IBW, Pplat 26-28 (see Box 1)
- Set PEEP according to ARDSNET (see Box 2)
- Permissive Hypercapnoea to pH > 7.25
- Oxygen Saturation > 92%
- NMB infusion first 48hrs if P/F < 130
- Use Bi-level Ventilation mode if possible
- Aim for Neutral Fluid Balance once CVS stable or 48hrs after ITU admission, whichever earlier

EXCLUDE:
- Distant Sepsis
- VAP
- Viral Infection – HSV, CMV, H1N1
- Pneumothorax
- Pleural Collection
- Pulmonary Embolus
- RV Dysfunction
- Intra-Abdominal Hypertension
- Sickle Trait (see Box 4)

PERSISTENT HYPOXAEMLIA

- Consider Prone Positioning early (16hr sessions)
- Optimise haemodynamics, target ScvO2 > 65%
- Trial bolus NMB⇒RM + avoid de-recruitment
- Recruit using High Frequency Oscillator (see Box 5)
- HiPEEP post RM if Pt Recruitable (see Box 2)
- Consider Aggressive Diuresis +/- CVVHF
- Consider NO / Flolan nebuliser (? B2 agonists )
- Reduce Targets: O2 Sats >88%, pH > 7.2
- Optimise Hb (target >10) and Albumin (Target >18)
- Consider ILA if pH < 7.15, pCO2 > 10 + RV failure
- Consider ECMO if < 7days ventilated

ARDS Differential:
- Pulmonary vasculitis
- PCP pneumonia
- LV failure
- Lymphangitis
- TRALI
- Interstitial pneumonitis
- Inhalational injury
- Anaphylaxis
Box 1 – Setting Tidal Volume:

Set TV at 4-6ml/kg Ideal Body Weight. Use mode that permits spontaneous ventilation eg BiLevel
Ideal Body Weight Calculation (height in inches):
- for Males = 50 + 2.3 (Ht – 60)
- for Females = 50 + 1.7 (Ht – 60)

Ensure Pplat < 30 (ideally < 28)
For Patients on Pressure Control / BiLevel modes, Pplat = Ppeak when end-inspiratory flow = zero
For Patients on Volume Control modes, use inspiratory hold manoeuvre to measure Pplat
For Patients with Primary ARDS (‘localized changes on CT) consider Pplat < 26

Allow Permissive Hypercapnoea, aiming for pH > 7.25, pCO2 < 11kPa
Absolute Contra-indication – Traumatic Brain Injury
Relative Contra-Indication – Pulmonary Hypertension

Box 2 – Setting PEEP:

Set PEEP initially according to ARDSNET 2000 PEEP Protocol:

<table>
<thead>
<tr>
<th>FiO₂ %</th>
<th>30</th>
<th>40</th>
<th>40</th>
<th>50</th>
<th>50</th>
<th>60</th>
<th>70</th>
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<td>8</td>
<td>10</td>
<td>10</td>
<td>12</td>
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<td>16</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>24</td>
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</tr>
</tbody>
</table>

For Pts with increasing FiO₂ / Pressure requirements
ONLY AFTER APPROVAL BY ICU CONSULTANT:
Assess likelihood for lung recruitment (Primary vs Secondary ARDS)
- At PEEP 5cmH2O note values for PaO₂, pCO₂, Compliance
- Perform Recruitment Manoeuvre (Ensure Pt well sedated, closely observe BP / CO):
  - 40cmH₂O CPAP (or 40-50 mPaw if on HFOV) for 40 seconds x 2 or
  - At TV 6ml/kg IBW, gradually increase PEEP from 15 to 25, Ppeak up to 45cmH₂O
- Reduce PEEP to 15cmH₂O and recheck PaO₂, pCO₂, Compliance
- If 2/3 values have improved by > 10%, Pt may benefit from Higher PEEP

Setting High PEEP – 2 methods:
- Titrate PEEP until, at 4-6ml/kg IBW TV, Pplat = 30cmH₂O
- After RM, reduce PEEP gradually until point of inflection on deflation slope of P-V curve reached ( = level of PEEP at max lung compliance) then re-recruit and set PEEP 2cmH₂O above this level

Box 3 – Primary vs Secondary ARDS

There is some evidence that ARDS caused by aetiologies that directly traumatize the lung (eg pneumonia, aspiration – Primary ARDS) may respond differently to ARDS caused by aetiologies distant from the lung (eg Trauma, non-lung sepsis, Pancreatitis – Secondary ARDS)
As well as different aetiologies, CT scans may also aid differentiation of the 2 (Primary ARDS = patchy changes, Secondary ARDS = more confluent, homogeneous changes on CT)

In terms of Mx:
- Primary ARDS – more vulnerable to volutrauma hence limit Pplat. Less likely to recruit hence limit PEEP. Primary ARDS due to CAP may benefit from 7day course of Low dose steroids from Day 1
- Secondary ARDS – more likely to recruit with High PEEP and higher Pplat. However, associated mortality also higher than Primary ARDS, most likely due to primary aetiology

Box 4 – Alternative Pathologies in ARDS

- Distant sepsis, particularly CVC related infection and Sinusitis
- Lung sepsis – as well as VAP, consider viral pneumonia and check NPA +/- Tracheal aspirates for HSV, CMV, H1N1
- Early CT scan – as well as 1st vs 2nd ARDS, may help direct BAL and exclude pneumothorax, PE, Empyema/abscess, Interstitial pneumonitis (as differential of ARDS)
- If no pathogen isolated, consider early BAL (esp. if immunosupressed – PCP, TB, Aspergillus, CMV, HSV)
- Consider Lung Biopsy if diagnosis still unclear (can change Mx in up to 50% cases)
- IAP common – if present, Pplat may significantly overestimate transpulmonary pressure
- RV dysfunction – present in approx 10%, diagnose on ECHO. Rx – Reduce Pplat / pCO2 if possible, NO, optimize lung recruitment, Prone position (best). Consider Sildenafil

Box 5 - HFOV Protocol

Initial Settings:
- mPaw + 5cmH₂O
- FiO₂ = 1.0
- Frequency 8Hz
- Cycle Vol. 175ml
- Bias Flow 20l/min

Beware overtirantia and barotrauma > 35cmH₂O
Contra-Indications – TICP, COPD

Oxygenation (Lung Recruitment)
Target PaO₂ > 8 kPa (FiO₂ = 1.0)

↑ mPaw by 2 cmH₂O and do ABG after 20 mins
Keep ↑ mPaw by 2 cmH₂O every 20 mins until O₂ target achieved or mPaw ≥ 40 cmH₂O

Ventilation (to clear CO₂)
Target: pH 7.25
Better High f and low Cycle volume if possible
↑ Cycle volume by 10 ml every 20 mins until max. for a given f
↓ f by 1 Hz every 20 mins until f = 5 Hz or pH > 7.25
If pH still < 7.25 - Introduce cuff leak - will need to ↑ bias flow

Weaning - Target PaO₂ > 8 kPa
- ↓ f by 1 Hz until mPaw = 30 cm H₂O every 4 hours until mPaw = 30 cm H₂O
- Next ↓ FiO₂ by 0.1 every 4 hours
- until FiO₂ = 0.4
- Next ↓ mPaw by 2 cm H₂O every 4 hours until mPaw = 18 cm H₂O
- Transition to Conventional Vent.
- SIMV – PC is suggested
- PEEP + 10/12 cm H₂O
- Adjust PC to give same mPaw as on HFOV