Respiratory Therapy Pocket Reference

Card design by Respiratory care providers from:

v 0.9

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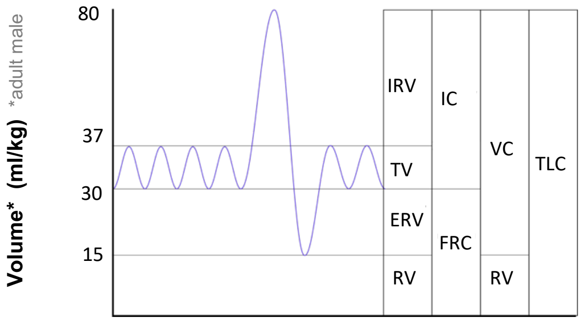
Oxygen & Delivery Devices

NC	**Pros:** Ubiquitous, easy; Range 1-8LPM **Cons:** Cold and dry if >4LPM, epistaxis **FiO2:** 2-4% /LPM; variable (mouth breathing, high minute ventilation)
NRB/ FM	**Pros:** Higher FiO2; Can be more comfortable than NC **Cons:** Bad if high MV; difficult to estimate severity of hypoxemia **FiO2:** Simple 5-10LPM (~FiO2 35-50%); NRB 10-15 LPM (~ FiO2 60-80% if MV not too high)
HFNC	**Pros:** Able to achieve high FiO2 even w/ high MV; washout CO2 (less rebreathing); heated/humidified; Possible improved outcomes in acute hypox resp failure Frat et al. *NEJM. 2015* **Cons:** Requires special device **FiO2:** >90% FiO2 (variability with MV, mouth breathing)
Heliox	**Pros:** Possibly decrease density = better ventilation **Cons:** Requires special device; Caution w/ 80/20 mix in severe hypercarbic failure; not all NIPPV or IPPV can use **FiO2:** 20% or 30% mixes available; $$$
NIPPV	**Pros:** May avoid intubation (COPD, cardiogenic pulm edema, mild ARDS, upper airway obstruction) by decr work of breathing & adding PEEP **Cons:** Gastric insufflation (if PIP>20-25); Cannot use if aspiration risk or unable to protect airway (or if can't remove mask themselves); uncomfortable/skin breakdown; may worsen lung injury due to increased transpulmonary pressure gradient; caution if RHF Confusing terminology: IPAP (=driving pressure + PEEP) and EPAP (=PEEP). PS of "5 over 5" is the same as PS delta 5 over 5, is the same as IPAP 10/EPAP 5 **FiO2:** 1.0 **Initial Settings:** PS (ΔP) 5 / PEEP (EPAP) 5-10; Titrate ΔP up to 15 to reduce inspr work Brochard et al. *NEJM* 1995 Winck et al. *Crit Care* 2006 Hilbert et al. *NEJM* 2001

Pulmonary Physiology

$P_{Plateau}$	Measure of static lung compliance. If in AC-VC, perform inspiratory pause (when there is no flow, there is no effect of Resistance; Pplat≅Palv); or set Pause Time ~0.5s; Target: < 30, Optimal: ~ 25
$P_{Peak\ inspiratory}$	PIP: Total inspiratory work by vent; Reflects resistance & compliance; Normal ~20 cmH20 (@8cc/kg and adult ETT); Resp failure 30-40 (low VT use); Concern if >40.
$P_{Driving}$	Pplat-PEEP: tidal stress (lung injury & mortality risk). Target ≤ 15 cmH2O. Signif mort risk ≥ 20 cmH2O.
I:E	At rest ~1:2, exertion ~1:1; Obstructive pulmonary dz ~1:3
Minute Vent	Normal 4-6 LPM; may be lower if drug OD, hypothermic, deep sedation; may be higher 8-14 LPM if OPD or ARDS. Target 6-8 LPM OPD, 10-15 ARDS
Peak Flow	Clinical range: 50-80 LPM. With exertion or distress 100-150; ventilator default ~60LPM
Compliance	$\Delta v / \Delta p = V_T$**/Plateau-PEEP** -Static compliance: (Normal ~100 mL/cmH2O) = lung (50) + chest wall (50); measured at end inspiratory pause; Normal intubated recumbent 60-80; ARDS ≤ 40) -Dynamic compliance: includes system resistance & inertia
Resistance	**R= PIP-Pplat/ inspir flow** (square pattern, 60LPM) Normal< 10cmH2O/L/sec, Concern: ≥ 15cmH2O/L/sec



Hypoxia

Alveolar Gas Equation (A-a)

$$[(Fi_{O2}\%/100) * (P_{atm} - 47\ mmHg) - (Pa_{CO2}/0.8)] - Pa_{O2}$$

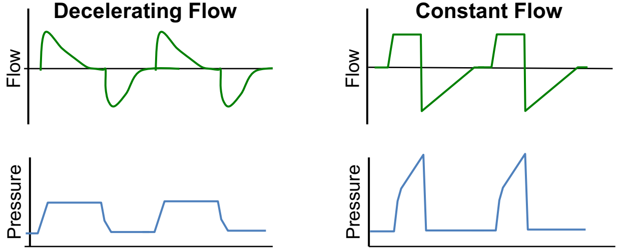
-Always small gradient = (age/4) +4; Patm sea level ~760mmHg
*PAO2 = function of oxygen in air (Patm-Pwater)FiO2 *and* ventilation (PaCO2/0.8)
*Remember, Patm *not* FiO2 changes with altitude (top of Everest, FiO2 = 0.21)
*Healthy subject on FiO2 1.0, ABG PaO2 ~660

Causes of Hypoxemia (PaO2)

*Normal A-a: Not enough 02 (low Patm, or low FiO2), too much CO2 (hypercarbia), hypoventilation
*Elevated A-a: Diffusion defect, V/Q mismatch, shunt

Volume Control

a.k.a.	"AC" Assist Control; AC-VC, ~CMV (controlled mandatory ventilation = all modes with RR and fixed Ti)
Settings	RR, Vt, PEEP, FiO2, Flow Trigger, Flow pattern, I:E (either directly or via peak flow, Ti settings)
Flow	Square wave/constant vs Decreasing Ramp (*potentially* more physiologic)
I:E	Determined by set RR, Vt, & Flow Pattern (i.e. for any set peak flow, Square (↓ Ti) & Ramp (↑ Ti); Normal Ti: 1-1.5s; 0.7-0.9sec to ↓ airtrapping & asynchrony -Increase flow rate will decrease inspiratory time (Ti) -Example: Vt 500/RR20/Flow 60 --Cycle time = 3s; Ti = 0.5s = (0.5L/60LPM)(60s per minute) --Texp = 3-0.5 = 2.5s → I:E = 0.5:2.5 = 1:5
Pros	Guaranteed MV regardless of changing respiratory system mechanics; Precise control of Vt to limit lung injury
Cons	Delivers Vt at all cost = PIPs vary with C & R; breath stacking; fixed flow and Ti can increase asynchrony when pt Vt and flow demand > vent settings
Breath Initiation	Control: Time trigger (60s/set RR): fixed VE Assist: Pt effort triggers full breath at set Ti and fixed VT and flowrate
If no pt trigger	Delivers full set Vt at set rate
Breath termination	Time cycled = breath ends at Ti limit; Alarms if VT not achieved; flow is set, breath ends once Vt delivered Pressure cycled = (safety mechanism); breath termination by clinician set high pressure limit; "pop-off" breath ends; Default set to 50 cmH2O
Notes	Inspiratory pause (~0.3s) can be built into each breath, will increase mean airway pressure

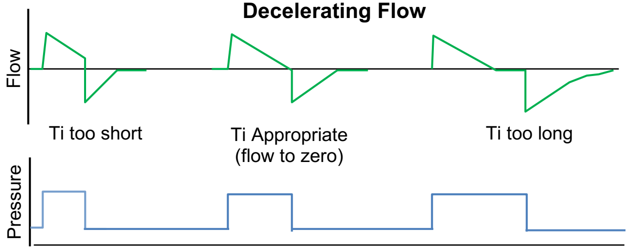


SIMV

a.k.a.	Synchronized intermittent mandatory ventilation; mixed mode
Pros	Guaranteed MV (control breaths by PC, VC, Dual); Spont breath (CPAP or PSV) = better synchrony; avoids breath stacking; sometimes useful if vent triggering inappropriately
Cons	Esteban et al. N Engl J Med 1995 Less 'control' over Vt and MV; May prolong weaning

Pressure Control

a.k.a.	AC-PC; Assist Control Pressure Control; ~CMV-PC
Settings	RR, Pinsp, PEEP, FiO2, Flow Trigger, rise time, I:E (set directly or by inspiratory time Ti)
Flow	- Decreasing Ramp (*potentially* more physiologic) - Peak Flow determined by 1) Pinsp level, 2) R, 3)Ti (shorter = more flow), 4) pressure rise time (↓ Rise Time → ↑ Peak Flow), 5) pt effort (↑ effort → ↑ peak flow)
I:E	Determined by set Ti & RR (Volume & flow variable) Time cycled = Ti or I:E set, then flow adjusts to deliver Vt
Pros	-Avoids high PIPs -Variable flow – ↑ pt effort causes ↑ flow to maintain constant airway pressure = *Potentially* better synchrony: ↑ pt effort → ↑ flow & ↑ Vt -"Automated/active expiratory valves" - transiently opens expiratory valve to vent off pressure w/ coughing, asynchrony. ↑comfort & ↓ barotrauma risk
Cons	VT and MV not guaranteed; Vt determined by C and R (might be bigger or smaller than is optimal)
Breath Initiation	Control: Time trigger – (60s/set RR) Assist: Pt trigger delivers Pinsp for inspiratory time cycle
If no pt trigger	Delivers Pinsp at set rate and Ti
Breath termination	Time cycled = I:E or Ti set, breath ends at set time
Notes	- When changing from AC-VC, set Pinsp as Pplat-PEEP from AC-VC or consider half of PIP from AC-VC - Can ↑Ti to allow pause or ↓Ti to ↑peak flow at the end inspiration ~decr asynchrony when VE demand is high

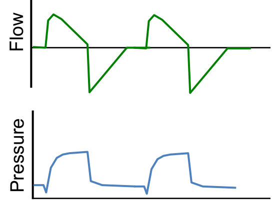


Misc Vent Settings

Insp Time	If Time-cycled, set I:E or Ti; If Volume cycled, flow is set; ~0.9s
Rise Time	Aka slope or flow attack; Speed of rise of flow (VC) or pressure (PC); how quick PIP reached; too short = uncomfortable; too long = low Vt (PCV) or higher P (VCV); ~0.2s fastest
Insp Trigger	Flow (3-5LPM) more sensitive than pressure trigger (-2cmH20)

Pressure Support

a.k.a	PS (~BiPAP). Spontaneous: Pressure-present
Settings	Pinsp, PEEP, FiO2, Flow Trigger, Rise time
Flow	Decreasing Ramp (*potentially* more physiologic) Determined by: 1) PS level, 2) R, Rise Time (↑ rise time → ↓ peak flow and 3.) pt effort
I:E	Determined by patient effort & flow termination ("E_{sens}" – see below "Breath Termination")
Pros	↑Synchrony: allows pt to determine peak flow, VT and Ti
Cons	No guaranteed MV; Vt determined by pt (big or small); high PS and/or low E_{sens} in COPD can incr air-trapping → asynchrony. Muscle Weakness/Fatigue: ↓ effort or ability to sustain effort)→ hypoventilation, ↑ fatigue
Breath Initiation	Pt flow or pressure triggered
If no pt trigger	Apnea; (Most vents will have backup rate; all have alarm)
Breath Termination	Flow cycled: Delivers Pinsp until flow drops to predetermined % of initial peak flow **~**E_{sens} (Standard setting ~25%; ~40-50% if OPD to prevent air trapping)
Notes	Higher Pinsp, short rise time, low trigger sensitivity = less work or air hunger; PS does not = SBT



Dual Mode

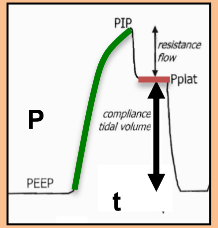
a.k.a.	Pressure regulated volume control (PRVC); VC+, AutoFlow ~PC with a target Vt & variable Pinsp (Δ1-3cmH2O per breath) to meet goal Vt despite chagning C and R;
Pros	↓ Likelihood of hypo/hyperventilation associated with PC when R or C changes. As C ↑ or R ↓ → Pinsp ↓. As C ↓ or R ↑→↑Pinsp. -Active expiratory valve present
Cons	- C & R can change significantly without notification - Vent can't discern if VT>target is due to ↑ Pt effort or ↑C; vent response to both = ↓ Pinsp; Can lead to closed-loop "runaway" (↓Pinsp→ ↑ Pt Effort→ ↓ Pinsp); ↑ Pt work Note: If PIP<20; evaluate for "VT starvation" (VT>set VT)

High Pressures

High PIP

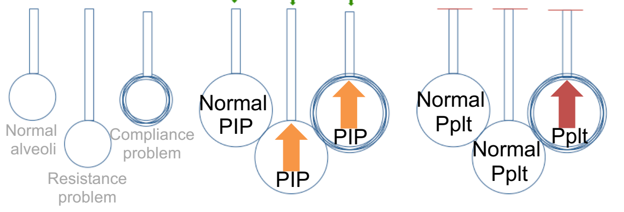
Ensure pt is sedated ± paralyzed, check plateau (insp hold):

- Incr Pplat, ΔPplat-PIP <10 → **Dx = low compliance**
- Incr Pplat, ΔPplat-PIP >10 → **Dx = low compliance + high resistance**
- nl Pplat, ΔPplat-PIP >10 → **Dx = high resistance**



Troubleshooting Resistance: work outside (machine) to inside (alveoli); circuit problem, ETT kink/occlusion/biting, ETT obstructed/mainstem, large airway obstruction (mucous plug), small/medium airway obstruction (bronchospasm); auscultation & passing a suction catheter can quickly eliminate many of these.

End Expiratory phase prior to breath | Inspiratory Flow opens alveoli; Determine PIPs | Inspiratory hold to measure Pplateau (force back against closed circuit)



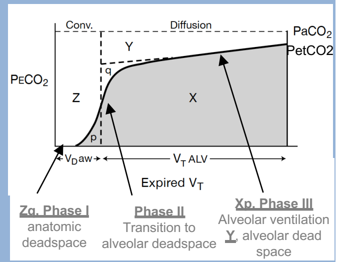
Deadspace Calculation

Gestalt Method

- Of 500mL VT, ~150mL = anatomic deadspace = normal (anatomic+alveolar = physiologic deadspace)
- During exhalation, at the alveolus, Palveolar CO2 ~ PaCO2; however, during expiration Palveolar CO2 is mixed with gas from anatomic and physiologic deadspace = diluted. Thus end tidal CO2 is always lower than PaCO2
- This difference (usually less than 5) can be used to estimate deadspace

Volume Capnography Method

- $P\bar{E}_{CO_2}$ (Mixed expired CO2) measured by integrating exhaled CO2 concentration and exhaled gas flow rate (NICO Monitor)
--Alveolar deadspace impacted by: hypovolemia (ie increased west zone I), pulmonary hypotension, PE, non-vascular deadspace, overdistension of alveoli (e.g. too much PEEP)



$$V_D/V_T = (PA_{CO_2} - P\bar{E}_{CO_2})/PA_{CO_2}$$

Bohr's equation uses A = alveolar; Enghoff uses PaCO2; E = mixed expired (not end tidal)

Setting PEEP

*PEEP doesn't recruit, it prevents de-recruitment, generally PIPs/Plts recruit

ARDSnet PEEP Tables
-In ARDS pts, use PEEP table; consider low PEEP if tenuous hemodynamics or other concerns for hemodynamic consequences of higher PEEPs

Gestalt Method
- Despite existence of numerous techniques (below), mean PEEP to maintain oxygenation in most major ARDS trials spans a narrow and moderate range (9-13)
- Many nuances and imprecisions to below methods make clinical utility limited
- Titrating PEEP to oxygenation is easy and reasonable, though pulmonary mechanics must be utilized, especially if poor oxygenation response
- Default 5, cardiogenic pulmonary edema 10, OPD 0-3, ARDS (use table)

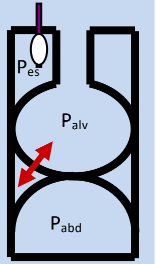
Static compliance Method
- Assess effect of PEEP changes in compliance
  - If Crs (respiratory system) improves, then attributable to alveolar recruitment; if Crs decreases, then overdistending;
  - Crs during PEEP titration largely determined by Vt chosen
- Goal is to set PEEP to match or exceed auto-PEEP (see auto-PEEP box)

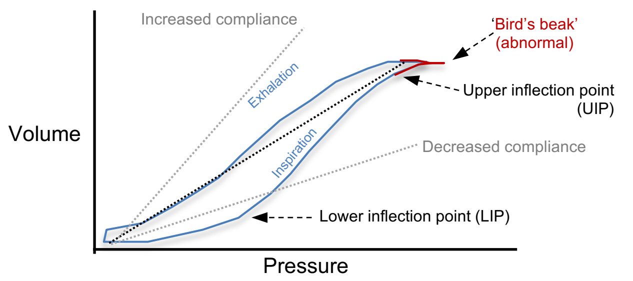
PEEP According to P-V Curves ("Open Lung Ventilation Strategy)
- Reduced inflammation & improved outcomes (NEED SOURCE)
- Results in higher PEEP needed than when using Crs technique
- Lower inflection point (LIP) = zone of recruitment
  - Set PEEP ~2 above LIP
- Upper inflection point = decreased Crs from overdistension - "birds beak"
  - Limit Vt so Pplat is below upper inflection point
- Limitations: accurate curves difficult to obtain unless patient paralyzed; LIP may represent Ccw (chest wall); may represent overcoming intrinsic PEEP f/lung with prolonged time constants; may represent only beginning of opening rather than optimal pressure for opening

Dead Space Method
-Vd/Vt spontaneous to detecting recruitment/derecruitment and overdistension

Esophageal Balloon
- May be useful if high BMI, abd pressure
- Transpulmonary pressure (Ptp) ~stress across lung - Allows PEEP and Vt titration accounting for Ccw (chest wall) and lung compliance
- Ppl = -2 resting; -5 nl Vt; -35 TLC
- Contraindications: varices, esoph trauma/surgery
-Titrate to end exp pressure (PEEP – Pes) = 0 -10 (higher pressure for higher FiO2 requirement; if EIP negative ~ alv collapse)
-Titrate Vt to maintain end-inspiratory transpulmonary pressure <25cmH20

$P_{alv\ insp} = P_{plat}$
$P_{alv\ exp} = PEEP_{tot}$
$P_{es} \sim P_{pleural}$
$P_{tp} = P_{alv} - P_{pl}$

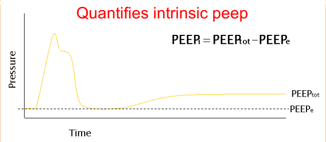




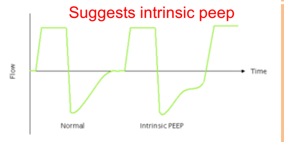
Obstructive Lung Disease

Goals	- Similar to ARDSnet – permissive hypercapnea and avoid barotrauma; Increase expiratory time (avoid breath stacking); shorten inspiratory phase, lower RR, trend pressures closely; Plat<40, pH>7.15, PaO2>60 - Avoid 'divots' (premature drop in exp flow to zero) = uncaptured breaths that hinder exhalation; titrate sedation prn - Be patient, severe exacerbations (esp asthma) can take time
Settings	Mode: VCV preferred as rapid changes in obstruction affect MV; consider PRVC if PIPs > 50 RR: ~10-14; Consider RR 6-9 if PEEPi still >5 despite E time 5s TV: 6-9ml/kg Insp Time/Flow: 0.7-0.9s / 60-80Lpm PEEP: start @0; may need 3-8 to ↓ work of breathing in recovery Exp time: goal 4-5s Heliox: only works w/select vents; limited data; consider if severe hyperinflation and/or acidosis; $$$
PEEPi - Intrinsic Peep	- Gas trapping: expiratory flow not returning to baseline (Quantified with expiratory pause; pt must remain apneic for ~5sec or more; assesses iatrogenic gas trapping best) - PEEPi trends with Vd/Vt (can be used to titrate PEEP) - Pplat might be best method to assess dynamic gas trapping

Quantifies intrinsic peep



Suggests intrinsic peep



Vent Liberation

SBT ~Criteria
1) F_{IO_2} ≤ 0.50 and PEEP ≤8, 2) No ↑ in PEEP/F_{IO_2} requirements over past 24hrs 3) pH > 7.30. V_E < 15 L/min, 4) ~MAP > 60 mmHg (minimal pressors), 5) ICP: non-labile and < 20 mmHg w/ CPP > 60 mmHg, 6) No MI in previous ~48hr

Weaning strategies — Esteban et al. N Engl J Med 1995
- Once daily SBT PS Δ 7/PEEP 5-8 cmH2O x 2hr (2nd daily trial permissible if failure was sedation-related or caused by some other transient issue)
- SBT x 30min ~probably as good as SBT x 2hr if <48h intubated
- SBT x 2hr better predictor if intubated >48h — Esteban et al. *Am J Respir CCM.* 1999
- If cardiogenic pulmonary edema risk: Consider 15min T-piece (ie d/c PS & PEEP)
- RSBI (rapid Shallow Breathing Index) = f/Vt is unreliable; <80 goal for extubation; sensitive, not specific (if > 105, good predictor of failure)
- Daily sedation interruption = faster extubation, shorter LOS — Kress JP et al. *NEJM*

Extubation 'criteria'
- Have you fixed the original problem?
- Adequate **oxygenation**? (Pa_{O_2} ≥ ~60 on PEEP≤ 8 cmH2O, F_{IO_2} ≤.50)
- Adequate **ventilation** w/o excessive **work of breathing**? (ΔPa_{CO_2} ↑ of < 10 mmHg with remaining pH > 7.30 during SBT)
- **Secretions**? (assess cough strength, suction frequency & secretion volume)
- **Airway protection?** (assess gag, spont cough and GCS)
  - Assess **risk of airway obstruction:** intubation ≥6d, trauma or multiple reintubations, large ETT, prolonged prone, flat, volume overload, head/necktrauma, among others
  - Cuff Leak Test: pt must be sedated (interaction with vent = incr PIP = incr leak = false reassurance); Mode: CMV-VC (V_T: 8-10 mL/kg, RR: 12-15, T_I: 1.5sec. Deflate cuff: Wait 6 breaths: expired VT should ↓ by ≥ 110mL.
  - *Extubation criteria/goals for neuro patients may be different (e.g. visual tracking, swallowing, GCS>10, <40yo) — Asehnoune et al. *Anesthesiology.* 2017
- **No upcoming procedures**
- **Hemodynamics** - reintubation of an unstable patient can be lethal

ARDS Management

Berlin Definition (2012)	1. Acute (<1 week) 2. Bilateral opacities on CXR or Chest CT 3. P:F ratio< 300mmHg w/ ≥5cmH20 PEEP 4. Must not be fully explained by cardiac failure or fluid overload on clinical exam — ARDS Task Force. *JAMA.* 2012
ARDS Severity	Mild = P/F 200 – 300 = ~27% mortality Moderate = P/F 100 – 200 = ~32% mortality Severe = P/F < 100 = ~45% mortality
Ventilator Set-Up per ARDSNet Protocol	1. Calculate ideal body weight **(IBW) to set VT – See box right** 2. Select vent mode (Usually start w/AC-VC , can use PC) 3. Set initial Vt = 8cc/kg IBW 4. Reduce Vt by 1 cc/kg as able until Vt = **6cc/kg IBW** 5. Adjust Vt and RR to achieve Pplat <30; pay attention to preintubation minute ventilation as initial guide 6. PEEP ≥5; FiO2/PEEP as below (see PEEP Box) 7. Oxygenation goal: PaO2 55-80; SpO2 88-95% 8. Ventilation goal: pH>7.15, permissive hypercapnea
Tidal Volumes	- Goal 6 cc/kg (range 4-6) - Consider decreasing below 6cc/kg if not meeting plateau goals - EVERY CC/KG counts! - Consider liberalization if/when: Oxygenation, C, Vd/Vt improving (PEEP≤10; FiO2≤60) *and* dysynch/uncomfortable
Fluid Management	**FACTT Trial** of conservative vs. liberal fluid strategy showed **conservative fluid strategy** → improved oxygenation, more ventilator-free & ICU-free days, no increased shock, no mortality effect — ARDSnet. *NEJM.* 2006 -concentrate drips, consider diuresis early if appropriate
$P_{plateau}$ & $P_{driving}$ Goals	Plateau Pressure: check at least q4h --if>30cmH20, consider decrease Vt by 1cc/kg steps --If <30cmH20 and dysynchrony and unable to address with sedation (and can't paralyze), consider increase by 1cc/kg Driving Pressure: deltaP=Vt/C_{RS} = Pplat-PEEP --Uses Vt normalized to functional aerated lung --Goal <15 (***each Δ7cmH2O =1.4 RR increase***) — Amato et al. *NEJM. 2015*
Paralysis	**ACURASYS Trial:** Paralysis w/in 48h, x48h, severe ARDS, 24% vs 33% @30d mortality benefit; placebo got more BDZs; some caveats w/data analysis — Papazian et al. *NEJM.* 2010 **ROSE Trial:** Similar to ACURASYS, larger (1006 pts), no mortality difference — PETAL. *NEJM.* 2019 --**Cisatracurium ($)**: Loading: 0.2 mg/kg; gtt: 0.5-10 mg/hr --**Vecuronium**: Loading: 0.08-0.1 mg/kg; gtt dose: 1-10 mg/kg
Vd/Vt	Measure Vd/Vt w/ vent changes; can be used to predict mortality (>60% = sig incr mortality), assess volume status, assess optimal PEEP
Proning	**PROSEVA** – most recent RCT, mortality benefit of proning (16% vs 33% @28d) **--Patient selection:** stabilized 12-24h severe ARDS **--Duration:** ~17h prone at a time, x4±4 sessions; until P:F>150 w/PEEP<10 supine x>4h — Guerin et al. *NEJM.* 2013 **--Equipment:** Don't necessarily need special bed
ECMO	- Ongoing trials to determine if benefit of ECMO in ARDS - Some centers use ECMO over proning for all severe ARDS - Existing data (**CESAR Trial**) support transfer to an ECMO center (not necessarily receiving ECMO) Consider ECMO for pt's not meeting ARDSnet goals — Noah et al. *JAMA* 2011; CESAR Trial. *Lancet* 2009

ARDS Management

Lower PEEP/higher FiO2

FiO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO_2	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

Higher PEEP/lower FiO2

FiO_2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
PEEP	5	8	10	12	14	14	16	16

FiO_2	0.5	0.5-0.8	0.8	0.9	1.0	1.0
PEEP	18	20	22	22	22	24

Ideal Body Weight:

Males = 50 + 2.3 [height (inches) -60]

Females = 45.5 + 2.3 [height (inches) – 60]

Selective Pulmonary Vasodilator Therapy

Inhaled Prostacyclin (aka: PGI_2)*
Dose: start at 50 ng/kg/min PBW (range: 10-50); should be weaned (10ng/kg/min increments q30min) to avoid hemodynamic compromise
Notes: Possibly more beneficial in secondary ARDS and pts with baseline RV dysfunction; incr surfactant production via cAMP pathway; antiplatelet activity only demonstrated thus far for IV route; half-life = minutes;

iNO*
Dose: 20ppm (range 2-80ppm); should be weaned (5ppm increments q30min) to avoid hemodynamic compromise
Notes: $, requires $ delivery equipment; no direct SVR effect; met-Hgb; half-life = seconds; free radicals; can cause acute LVEDP overload (caution if reduced LV function); caution of pulm hemorrhage, plts<50 or anticoagulated

*No survival data; Caution: pulm vasodilators can cause incr LVEDP; do not use if pulmonary hemorrhage

Recruitment Maneuvers

- **Caution: can kill a pt. Check with attending and RT - many contraindications**
- **Must have** arterial line; adequately sedated and/or paralyzed patient
- **Consider if (approximately):** FiO2 ≥70%, 16 PEEP and P:F≤150
- Threshold opening pressure <35 in most ARDS pts; AC-PC more stable and effective than sustained inflation RM

Iannuzzi et al. *Min Anes.* 2010
Borges et al. *Am J R CCM.* 2006

Example Protocol:
- AC-PC Pdr 15-20, PEEP 20; RR 20; I:E 1:1 (Ti 1.5s)
- Increase PEEP q2min by 5cmH20 to max 50/35 (if tolerated hemodynamically)
- Return to 40/25 5-15min
- Then decremental PEEP trial

(If hypoTN or TBI, consider PEEP 16 and Pdr 20; Increase Pdr q2min by 5cmH20 to max 50/16 then back to 15-20/16)

Post RM Stabilization:
Wean by decremental PEEP trial: f/25cmH20 by 2-3cmH20 q5-10min until desats (target SpO2 90% throughout in order to be able to assess real-time effects)

Vent Associated Pneumonia

- **Dx:** PNA in pt intubated/ventilated x 48h prior to onset; new infiltrate plus ≥1 of (new fever, WBCs, >70yo w/AMS) AND ≥2 of (sputum, cough, SOB, worse P:F or exam findings); For additional/alternate PNA criteria see – CDC VAP Definitions
Order trach asp (non quantitative Cx), though not required for Dx
- **Prevention measures:** HOB>30, mouthcare, adequate ETT cuff pressure ± subglottic suctioning*, decrease # of transports f/ICU.
- **Tx:** MSSA + pseudomonal coverage; MRSA tx if risk factors; double cover pseudomonas if MDR risk factors; de-escalate abx at 48-72h pnd cultures ± procalciitonin trend; ≤7d course or if pseudomonas consider 14d course

Kallil et al. IDSA Guidelines. *Clin Infect Dis.* 2016