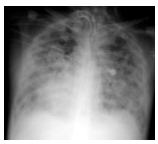


ARDS Management Protocol

February 2018

	ARDS Criteria
	Onset Within 1 week of a known clinical insult or new or worsening respiratory symptoms
	Bilateral opacities—not fully explained by effusions, lobar/lung collapse, or nodules
	Respiratory failure not fully explained by cardiac failure or fluid overload Need objective assessment (eg, echocardiography) to exclude hydrostatic edema if no risk factor present
	PaO2/FIO2 ≤ 300 mm Hg with PEEP or CPAP ≥ 5 cm H_2O
	Severity of Illness
	Mid: 200 mm Hg < PaO2/FIO2 ≤ 300 mm Hg with PEEP or CPAP ≥ 5 cm H_2O
	Moderate: 100 mm Hg < PaO2/FIO2 ≤ 200 mm Hg with PEEP ≥ 5 cm H_2O
	Severe: PaO2/FIO2 ≤ 100 mm Hg with PEEP ≥ 5 cm H_2O
	Calculations
	Calculate Ideal Body Weight (IBW): Men = 50 + [(height (*cm*) -154) x 0.9] Women = 45.5 + [(height (*cm*) -154) x 0.9]
	Desired minute ventilation (MV)= IBW * 125
A	Set Targets
	Tidal volume 4-6 ml/kg of IBW
	Plateau pressure: <30 cm H_2O (preferably <28 cm H_2O), may accept higher plateau If patient has stiff chest wall or abdominal limitation (e.g., with massive ascites, large pleural effusion or obese patients)
	Driving pressure < 15 cm H_2O
	pH: 7.25-7.45
	PaO_2 55-80 mmHg or SpO_2 88-95% and FiO_2 ≤ 60%
1	Volume Control Mode
	Pressure Regulation Mode (PRVC, CMV with autoflow, AC+, or APVcmv)
	Set volume at 6 mL/kg of IBW
	Decrease volume at 1 mL/kg to achieve the set plateau pressure goal
	Set pressure alarm limit 37-50 cm H_2O (dependent on the type of ventilator)

Set rate at desired minute ventilation/VT: The respiratory rate will be set to avoid air trapping whenever possible as determined by the inspection of the flow tracing and/or measurements of intrinsic PEEP.

Adjust rate for the pH goal

1	Pressure Control Mode

Set pressure control less than 30

Adjust pressure to maintain VT 4-6 mL/kg of IBW

Set rate at desired minute ventilation/VT: The respiratory rate will be set to avoid air trapping whenever possible as determined by the inspection of the flow tracing and/or measurements of intrinsic PEEP.

1	PEEP Titration: Low PEEP/FiO_2 Table

FiO_2%	**30**	**40**	**40**	**50**	**50**	**60**	**70**	**70**	**70**	**80**	**90**	**90**	**90**	**100**
PEEP (cm H2O)	5	5	8	8	10	10	10	12	14	14	14	16	18	18-24

2	PEEP Titration: High PEEP/FiO_2 Table

FiO_2%	**30**	**30**	**30**	**30**	**30**	**30**	**40**	**40**	**50**	**50**	**50-80**	**80**	**90**	**100**	**100**
PEEP (cm H2O)	5	8	10	12	14	14	16	16	18	20	14	22	22	22	24

3	Paralysis

Use within the first 48 hours
Severe ARDS with PEEP/FiO2 <150
Intravenous injection of 20 mg of cisatracurium (may repeat if a decrease of the end-inspiratory plateau pressure by less than 2 cm of water was noticed)
May use continuous infusion for paralysis
Ensure adequate sedation with RASS -4 to -5

3	Recruitment Maneuver

Moderate or severe ARDS
Continuous positive airway pressure (CPAP) mode and increase the pressure to 30–40 cmH2O for 30–40 s
Monitor hemodynamics and possibility of pneumothorax
Caution in patients with preexisting hypovolemia or shock

4	Esophageal Pressure Monitoring

Moderate to severe ARDS or conditions with increase thoracic or intraabdominal pressures, (i.e obesity)

B	Transpulmonary Pressure Targets

Transpulmonary pressure in inspiration (Insp PL) <30

Transpulmonary pressure in expiration (Exp PL): 0-10
Transpulmonary driving pressure (True Driving Pressure: DPtp) <15

C	Contraindication to prone position

Increased ICP
Massive hemoptysis
Tracheal surgery or sternotomy <2 weeks
Facial trauma or surgery < 2 weeks including neck trauma or spinal instability
Pregnancy
DVT treated < 2days
large ventral surface burn
Cardiac pacemaker inserted < 2days
Unstable spine, pelvic, or femur fracture
Morbid obesity
Patients at high risk of requiring CPR or defibrillation
Staff judgement

5	Trial of prone position

Who to place in prone position?

- Patients with severe ARDS (PaO2/FiO2 < 150 mm Hg)
- Early in the course (ideally within 48 h)
- Best outcomes reported when prone positioning is used in combination with both low tidal volume ventilation (6 cc/kg) and neuromuscular blockade

How to place patient in prone position?

- Requires 3-5 people, close attention to endotracheal tube (ETT) and central lines
- Preparation: preoxygenation, empty stomach, suction ETT/oral cavity, remove ECG leads and reattach to back, repeated zeroing of hemodynamic transducers
- Support and frequently reposition pressure points: face, shoulder, anterior pelvis

How long to have patient in prone position each day?

- Successful trials use at least 16 hours of daily proning
- Long prone positioning sessions likely avoid derecruitment

When to stop?

- In PROSEVA, prone positioning was stopped when PaO2/FiO2 remained > 150 mm Hg 4 h after supinating (with PEEP < 10 cm H2O and FiO2 < 0.6)
- Optimal strategy is unclear: consider continuing prone positioning until clear improvement in gas exchange, mechanics, and overall clinical course.

Potential complications

- Temporary increase in oral and tracheal secretions occluding airway
- ETT migration or kinking
- Vascular catheter kinking
- Elevated intraabdominal pressure
- Increased gastric residuals
- Facial pressure ulcers, facial edema, lip trauma from ETT, brachial plexus injury (arm extension)

D	ECMO Eligibility

Severe hypoxemia (PaO2/FiO2 ratio <80 mmHg) despite conventional and appropriate therapies for at least 6 hours in acute reversible lung disease
Uncompensated hypercapnia with acedemia (pH <7.15) despite best accepted standard of ventilatory care.
Presence of excessively high end-inspiratory plateau pressures (>35 cm H_2O) despite best accepted standard of ventilatory care.
No terminal disease (expected survival >6 months)
Intact neurological status
No limited vascular access
Respiratory support < 7 days (relative)

6	ECMO

http://www.nejm.org/doi/full/10.1056/NEJMct1103720

8	APRV

High airway pressure (P_{high}) at the P_{plat} measured at the previous VCV settings +5 (not to exceed 30 cmH2O)
Low airway pressure (P_{low}) at 5 cmH2O (minimal pressure level was used to prevent atelectasis per standard practice)
Duration of release phase (T_{low}) at one- to 1.5-fold the expiratory time constant, and then adjust to achieve a termination of peak expiratory flow rate (PEFR) of ≥50% of PEFR
Release frequency at 10–14 frequency/min
Duration of P_{high} (T_{high}) is indirectly calculated based on the T_{low} and release frequency
Spontaneous respiratory level targeted as spontaneous minute ventilation (MV_{spont}), approximately 30% total minute ventilation (MV_{total})

8	HFV

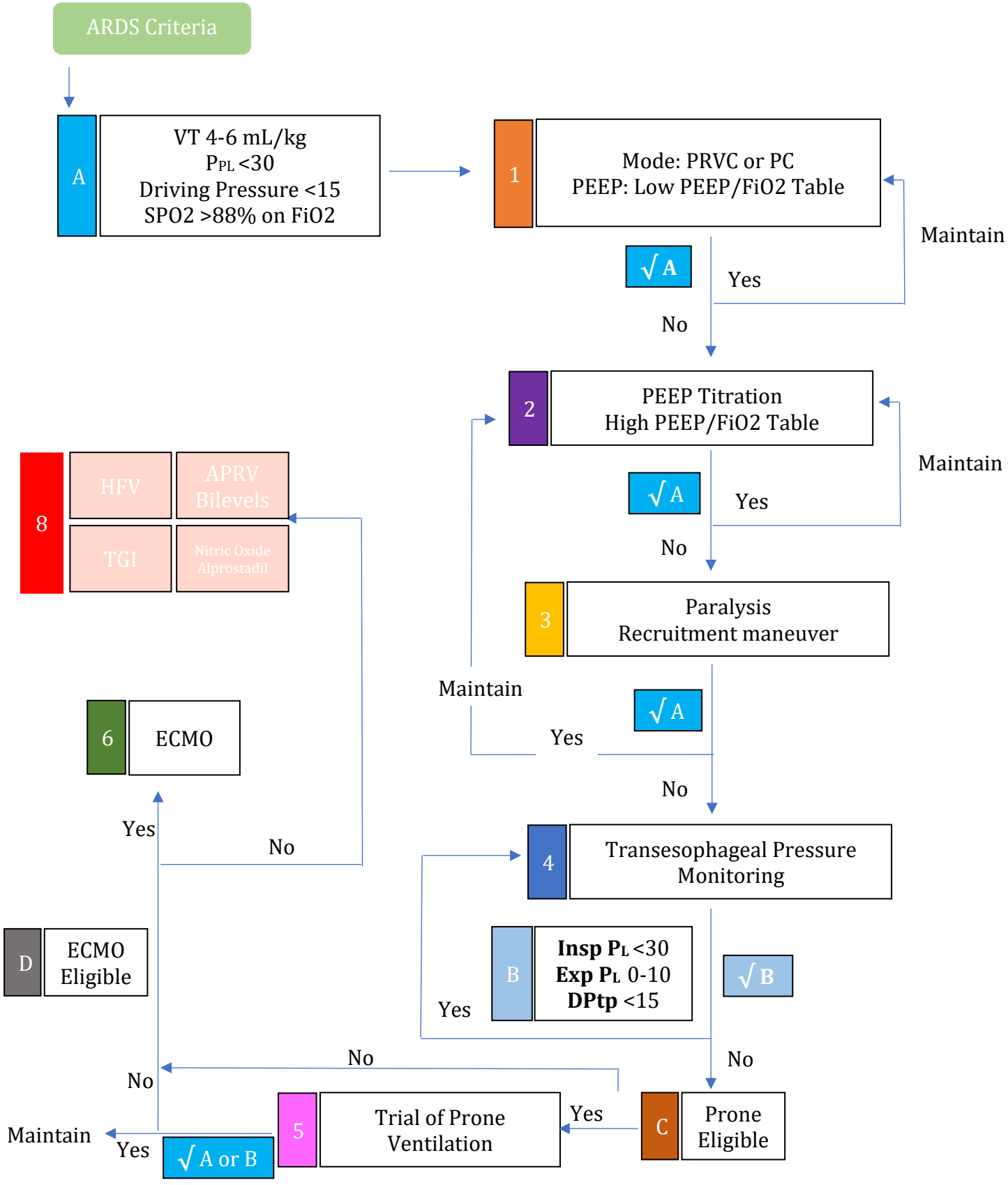
Bias flow 40 L/min
Inspiratory time 33%
mPaw 30 cm H2O
FIO2 1.0
Amplitude (delta P) 90 cm H2O.
Initial frequency based on most recent arterial blood gas:

- pH <7.10 = 4 Hz
- pH 7.10–7.19 = 5 Hz
- pH 7.20–7.35 = 6 Hz
- pH >7.35 = 7 Hz

8	Vasodilators: epoprostenol (aEPO)

Initiate aEPO at 50 ng/kg/min (based on ideal body weight – IBW, rounded to nearest 10kg) via continuous nebulization with nebulizer connected to the ventilator
aEPO should be titrated downward every 30 minutes as tolerated to 10 ng/kg/min based on PaO2 improvement.
Do NOT decrease aEPO by more than 10 ng/kg/min every 30 minutes

	https://www.universityhealthsystem.com/~/media/files/clinical-pathways/inhaled-epoprostenol-guideline-1114.pdf?la=en
8	Tracheal Gas Insufflation (TGI)
	https://www.atsjournals.org/doi/pdf/10.1164/ajrccm.162.2.9910111


ARDS Criteria
A
VT 4-6 mL/kg
PPL <30
Driving Pressure <15
SPO2 >88% on FiO2
1
Mode: PRVC or PC
PEEP: Low PEEP/FiO2 Table
√ A
Yes
Maintain
No
2
PEEP Titration
High PEEP/FiO2 Table
√ A
Yes
Maintain
No
3
Paralysis
Recruitment maneuver
√ A
Yes
Maintain
No
4
Transesophageal Pressure Monitoring
B
Insp PL <30
Exp PL 0-10
DPtp <15
√ B
Yes
No
C
Prone Eligible
Yes
5
Trial of Prone Ventilation
√ A or B
Yes
Maintain
No
6
ECMO
Yes
D
ECMO Eligible
No
8
HFV
APRV
Bilevels
TGI
Nitric Oxide
Alprostadil