Respiratory Care for COVID-19 patients

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May 2nd ,2021

Conflicts of interest to declare

I have no personal and financial interests to declare

Topics to cover

- International guideline
- Practice guideline in Thai
- Mechanical ventilator & adjuncts technique

Oxygenation and Ventilation

Last Updated: December 17, 2020

Target SpO_2 of 92% to 96

Nonmechanically Ventilated Adults With Hypoxemic Respiratory Failure

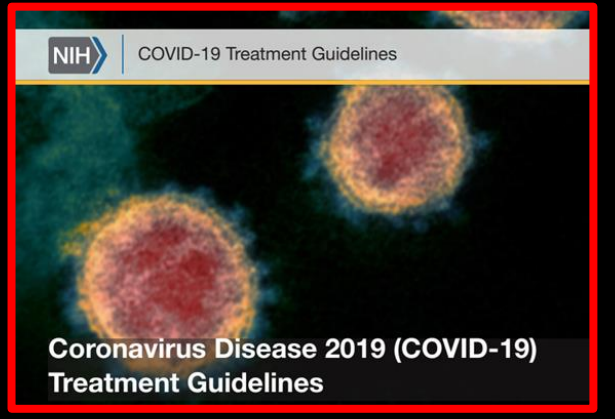
High-flow nasal cannula (HFNC) oxygen over noninvasive positive pressure ventilation (NIPPV) (BIIa)

Closely monitored trial of NIPPV for whom HFNC is not available (BIIa)

Persistent hypoxemia considering a trial of awake prone positioning to improve oxygenation (CIIa)

Awake prone positioning to avoid intubation mechanical ventilation (AIII)

Intubation performed by an experienced practitioner in a controlled setting (AIII)



OK

NO

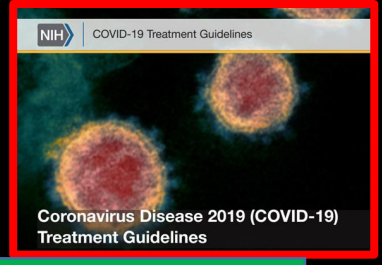
Oxygenation and Ventilation

Last Updated: December 17, 2020

Mechanically Ventilated Adults

OK

NO



Low tidal volume (VT) ventilation (VT 4–8 mL/kg of predicted body weight) over higher VT ventilation (VT >8 mL/kg) (AI)

Targeting plateau pressures of <30 cm H_2O (AIIa)

Conservative fluid strategy over a liberal fluid strategy (BIIa)

Routine use of inhaled nitric oxide (AIIa)

Moderate-to-severe ARDS:higher positive end-expiratory pressure (PEEP) strategy over a lower PEEP strategy (BIIa).

Refractory hypoxemia: Prone ventilation for 12-16 hrs /day over no prone ventilation (BIIa).

Intermittent boluses of neuromuscular blocking agents (NMBA) or continuous NMBA infusion to facilitate protective lung ventilation (BIIa)

Persistent patient-ventilator dyssynchrony , prone ventilation, or persistently high plateau pressures, :continuous NMBA infusion for up to 48 hours as long as patient anxiety and pain can be adequately monitored and controlled (BIII)

Recruitment maneuvers rather than not using recruitment maneuvers (CIIa)

Incremental PEEP recruitment maneuvers (AIIa)

Expert consensus statements for the management of COVID-19-related acute respiratory failure using a Delphi method

Nasa *et al. Crit Care* (2021) 25:106
https://doi.org/10.1186/s13054-021-03491-y

*Strong statement (a median of≥6 or≤2 on the Likert scale or > 90% votes for any MCQ option were achieved).

Interventions	Expert Clinical Practice Statements
Awake self proning 	1. Awake self proning may be considered to improve oxygenation. It should be used when supplemental oxygen is required to maintain SpO2 > 90%*
HFNO 	2. HFNO should be considered as an alternative strategy for oxygen therapy* 3. HFNO should be used in patients who are unable to maintain SpO2 >90% using high flow oxygen delivery through a mask* and may also be used in patients who have increasing oxygen requirement 4. HFNO may be useful to avoid the need for tracheal intubation and invasive mechanical ventilation
NIV 	5. NIV use should be considered in patients with mixed respiratory failure* and may also be used for progressively increasing work of breathing (observed subjectively)
Tracheal Intubation 	6. Tracheal intubation and initiation of invasive mechanical ventilation should be considered in patients with altered mental status* and may also be considered in hemodynamically unstable patients or when other non-invasive respiratory interventions fail to maintain SpO2 > 90%

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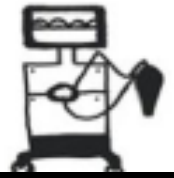
Interventions	Expert Clinical Practice Statements
Invasive Mechanical Ventilation 	7. A lung protective ventilation strategy should be used in patients on invasive mechanical ventilation * 8. NMBA should be considered during the early phase of invasive mechanical ventilation in case of patient-ventilator dyssynchrony*
Prone Ventilation 	9. Prone ventilation in patients on invasive mechanical ventilation should be used for a duration of 16-24 hours per session, to improve oxygenation*
Recruitment Maneuver 	10. Recruitment manoeuvres may be considered in select patients on invasive mechanical ventilation, in view of their potential deleterious effects
ECMO 	11. V-V ECMO may be considered in patients with refractory hypoxemia who do not respond to other adjuvant therapies
Weaning 	12. Liberation from invasive mechanical ventilation should not be delayed, in order to reduce the risk of reintubation* 13. A PSV trial (for 30 minutes to two hours) may be preferred over other weaning strategies for liberation from invasive mechanical ventilation

Expert consensus statements for the management of COVID-19-related acute respiratory failure using a Delphi method

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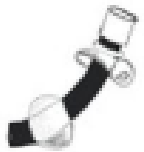
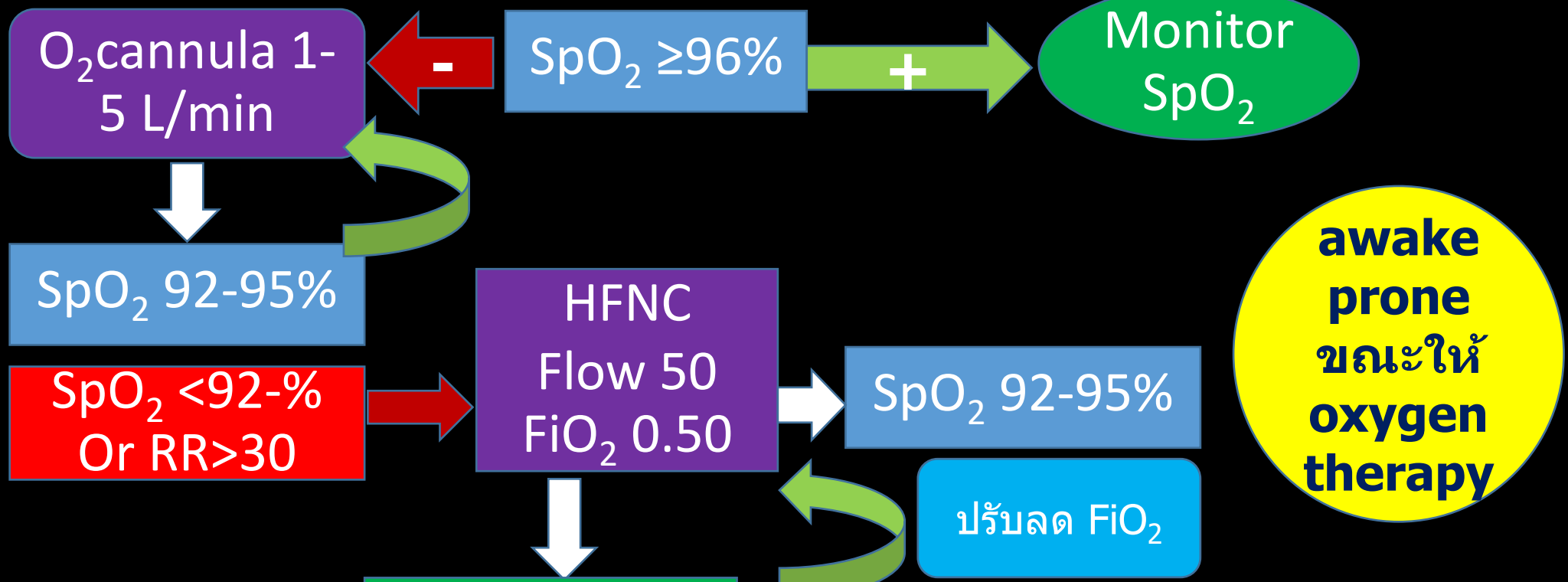
Interventions	Expert Clinical Practice Statements
Tracheostomy 	14. The timing of tracheostomy, to facilitate weaning from invasive mechanical ventilation, should be the same as in a non-COVID-19 patients* 15. Percutaneous tracheostomy (with or without guidance of ultrasound or bronchoscopy) may be preferred over other techniques
Corticosteroid 	16. Systemic corticosteroids should be considered in patients with critical COVID-19, to avoid the need for tracheal intubation and invasive mechanical ventilation * 17. Dexamethasone may be preferred over other systemic corticosteroids and should be used at a dose of 6 mg*daily for 5-10 days
Mobilization 	18. Early mobilisation may be beneficial in patients on respiratory support
Infection Control 	19. Bag and mask ventilation*, nebulization*, HFNO, NIV*, tracheal intubation*, open suctioning*, bronchoscopy*, tracheal extubation*, and tracheostomy may be considered as aerosol generating procedures in ICU 20. Airborne infection isolation rooms and videolaryngoscopes may be considered during tracheal intubation.; a closed suction system* should be considered to reduce cross-transmission of SARS-CoV-2 in ICU

Oxygen therapy

คำแนะนำการรักษาปอดอักเสบโควิด-19

โดย รศ.นพ.นิธิพัฒน์ เจียรกุล



awake prone ขณะให้ oxygen therapy

US-CDC ไม่จัด HFNC เป็น high-risk aerosol generating procedure จึงสามารถใช้งานนอก isolation room ได้

บุคลากรขณะดูแลผู้ป่วยให้ใช้ airborne protection

ใช้ surgical mask ปิดทับปากและจมูกผู้ป่วยขณะใช้ HFNC

Covid-19 with acute respiratory failure

COVID-19 pneumonia: different respiratory treatments for different phenotypes?

Luciano Gattinoni[1*], Davide Chiumello[2], Pietro Caironi[3,4], Mattia Busana[1], Federica Romitti[1], Luca Brazzi[5] and Luigi Camporota[6]

Intensive Care Med (2020) 46:1099–1102

PaO_2/FiO_2
84 mmHg

PaO_2/FiO_2
95 mmHg

Type H patient:

- High elastance
- High right-to-left shunt (V/Q)
- High lung weight
- High lung recruitability

- Type L
- Low elastance
- Low right-to-left shunt (V/Q)
- Low lung weight
- Low lung recruitability

COVID-19 pneumonia: different respiratory treatments for different phenotypes?

Luciano Gattinoni[1*], Davide Chiumello[2], Pietro Caironi[3,4], Mattia Busana[1], Federica Romitti[1], Luca Brazzi[5] and Luigi Camporota[6]

- 1st step to reverse hypoxemia is through an increase in FiO_2 to which the Type L patient responds well, particularly if not yet breathless.
- Type L patients with dyspnea, several noninvasive options are available: high-flow nasal cannula (HFNC), continuous positive airway pressure (CPAP) or noninvasive ventilation (NIV)
- Surrogate measures of work of breathing, such as the swings of central venous pressure or clinical detection of excessive inspiratory effort, should be assessed
- Esophageal pressure swings increase from 5 to 10 cmH2O—which are generally well tolerated—to above 15 cmH2O, the risk of lung injury increases and therefore intubation should be performed as soon as possible

Intensive Care Med (2020) 46:1099–1102

COVID-19 pneumonia: different respiratory treatments for different phenotypes?

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- Once intubated and deeply sedated, the Type L patients, if hypercapnic, can be ventilated with volumes > 6 ml/kg (up to 8–9 ml/kg), as the high compliance results in tolerable strain without the risk of VILI
- Prone positioning should be used only as a rescue maneuver
- PEEP should be reduced to 8–10 cmH_2O
- Type H patients should be treated as severe ARDS , including higher PEEP, if compatible with hemodynamics, prone positioning and extracorporeal support

Intensive Care Med (2020) 46:1099–1102

Identification of pathophysiological patterns for triage and respiratory support in COVID-19

*Luigi Camporota, Francesco Vasques, Barnaby Sanderson, Nicholas A Barrett, Luciano Gattinoni

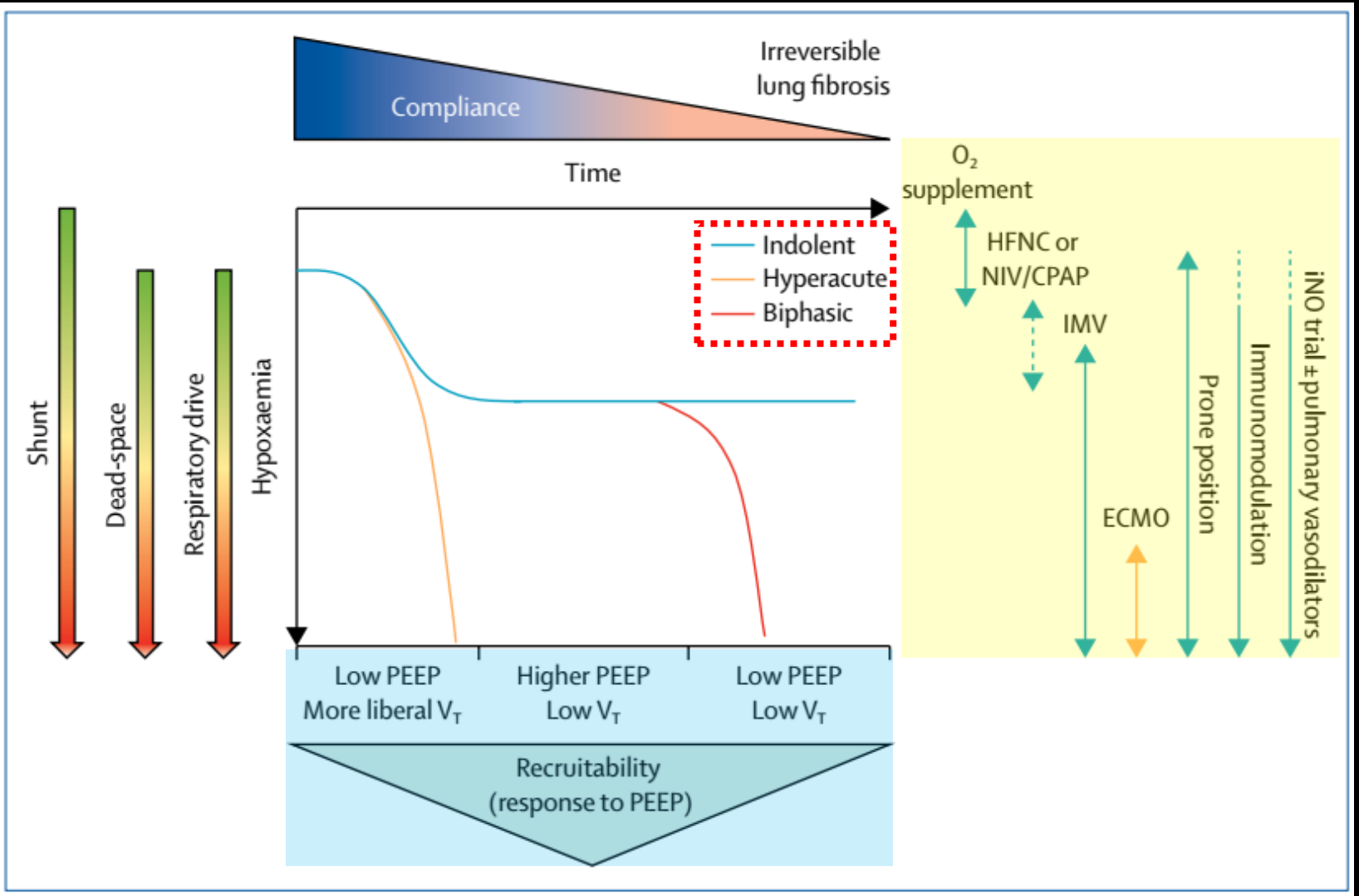


Figure: Pathophysiological trajectory in COVID-19 and proposed implications for respiratory support

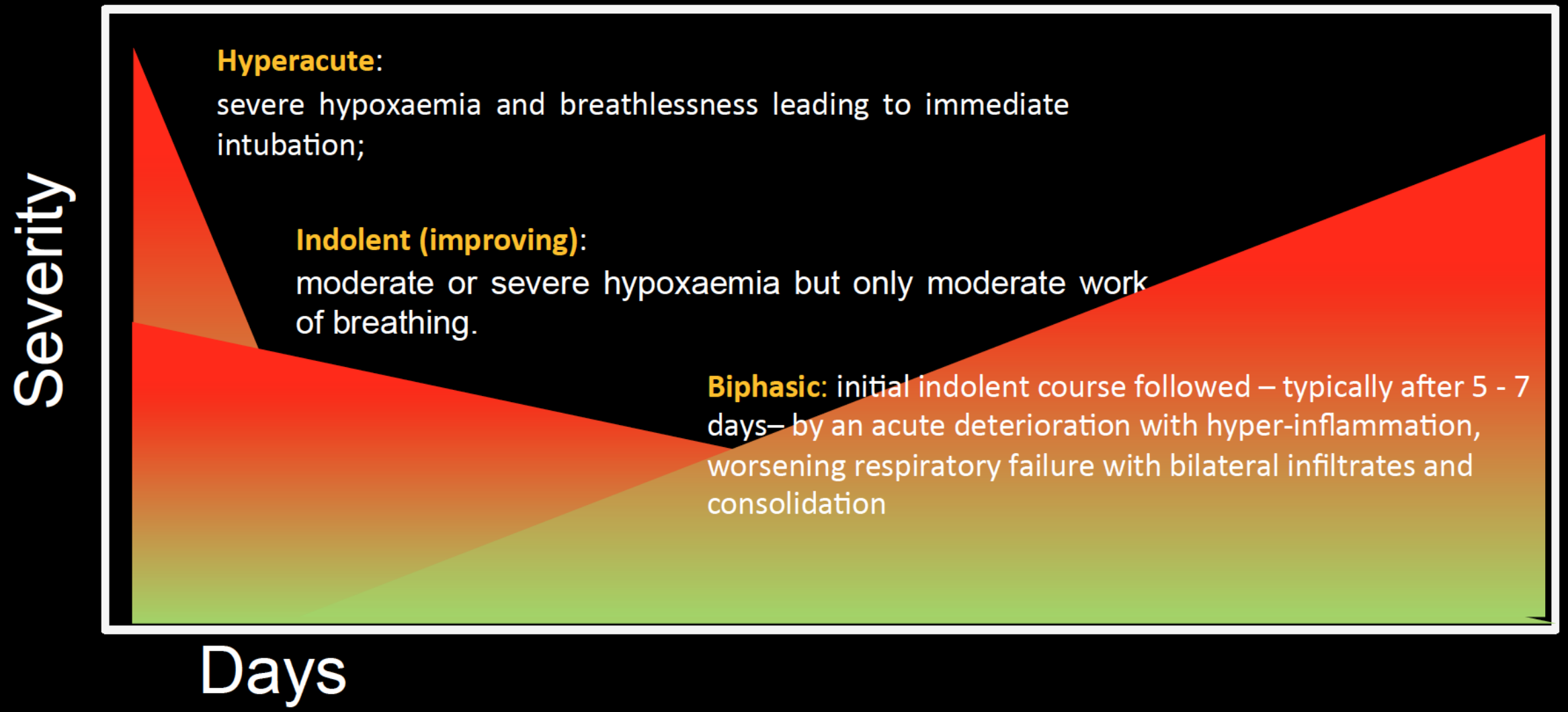
Data derived from the UK Intensive Care National Audit and Research Centre (ICNARC) Case Mix Programme Database show that, for the first 8062 patients admitted to the ICU across the UK with documented outcomes, by May 29, 2020, about 72% received advanced mechanical ventilation and the mortality rate was around 53%

CPAP=continuous positive airway pressure.
ECMO=extracorporeal membrane oxygenation.
HFNC=high-flow nasal cannula.
IMV=invasive mechanical ventilation.
iNO=inhaled nitric oxide.
NIV=non-invasive ventilation.
PEEP=positive end-expiratory pressure.
VT=tidal volume

www.thelancet.com/respiratory Vol 8 August 2020

https://doi.org/10.1016/S2213-2600(20)30279-4

Disease Course and late “failures”



JAMA Insights | CLINICAL UPDATE

Management of COVID-19 Respiratory Distress

John J. Marini, MD; Luciano Gattinoni, MD

JAMA Published online April 24, 2020

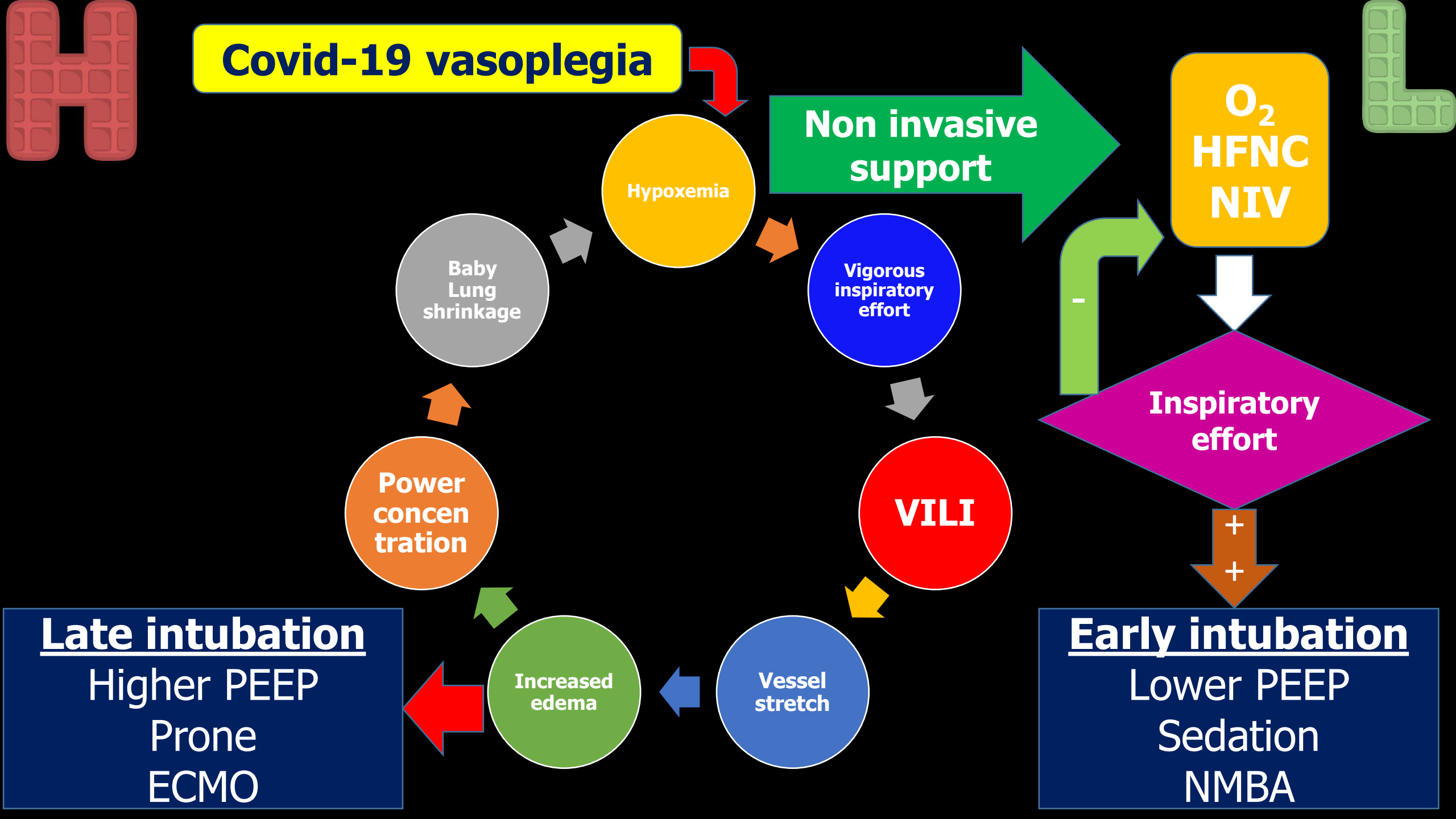
Table. Time Course and Treatment Approach to Ventilation Support for Patients With CARDS

Time period	Objective	Respiratory support options	Rationale
Before intubation	Adequate gas exchange Avoid P-SILI	Supplemental oxygen, CPAP, NIV, HFNC Awake prone positioning, Target nonvigorous breathing	Powerful respiratory effort can cause reinforcing lung and vascular stress, resulting in injury
During mechanical ventilation	Avoid pulmonary deterioration and VILI vortex	Minimize PEEP, frequency and tidal volume Adjust to acceptable gas exchange Maintain fluid balance Reduce O_2 demand Consider ECMO	Minimize transpulmonary and vascular stresses
After intubation	Minimize pulmonary stress Optimize O_2 Avoid VILI vortex	Type L[a]: use lower PEEP (<10 cm H_2O) Use more liberal tidal volume (7-9 mL/kg) as needed Reduce O_2 demand Consider prone positioning	Lower tidal volumes are unnecessary Higher PEEP is ineffective, creates dead space, and adversely redirects blood flow
	Reduce and evenly distribute lung and vascular stresses Optimize O_2 Avoid VILI vortex	Type H[a]: use higher PEEP (<15 cm H_2O) Lower tidal volume (5-7 mL/kg) Reduce O_2 demand Implement prone positioning	More closely behaves and responds like typical ARDS
Weaning phase	Avoid reversion to previously worsened pulmonary state by causing VILI and worsening edema	Make transitions cautiously Avoid abrupt changes Spontaneous trials only at the very end of the weaning process	Strong spontaneous efforts raise O_2 demand, increase edema, and promote P-SILI

CARDS: COVID-19 with ARDS
P-SILI: patient self-inflicted lung injury

Type L: Scattered ground-glass infiltrates, higher compliance (>50 mL/cm H2O), not PEEP responsive; less dyspnea.

Type H: Extensive infiltrates of atelectasis and edema, lower compliance, PEEP responsive, overtly dyspneic

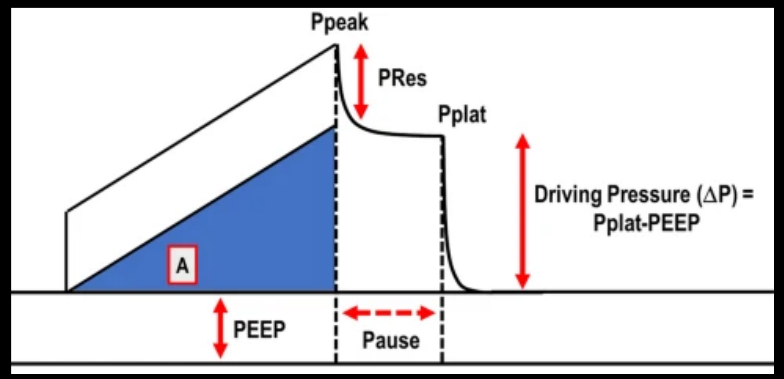

H
Covid-19 vasoplegia
Hypoxemia
Non invasive support
O_2
HFNC
NIV
L
Vigorous inspiratory effort
Inspiratory effort
-
+
+
VILI
Vessel stretch
Increased edema
Power concen tration
Baby Lung shrinkage
Late intubation
Higher PEEP
Prone
ECMO
Early intubation
Lower PEEP
Sedation
NMBA

Respiratory care in Covid-19

Assessment of "Shunt fraction"

Assessment of "P-SILI"

Target SpO_2 88-94%
Ppl≤ 28 cmH_2O
pH 7.3-7.4



O_2 cannula 1-5L/min

Target SpO_2 92-96%

≤ 91%

Inspiratory effort

High

Intubation

VC mode
Vt 8 ml/kg/IBW
PEEP 8 cmH_2O
RR 20-25/min

Sedation*

Low

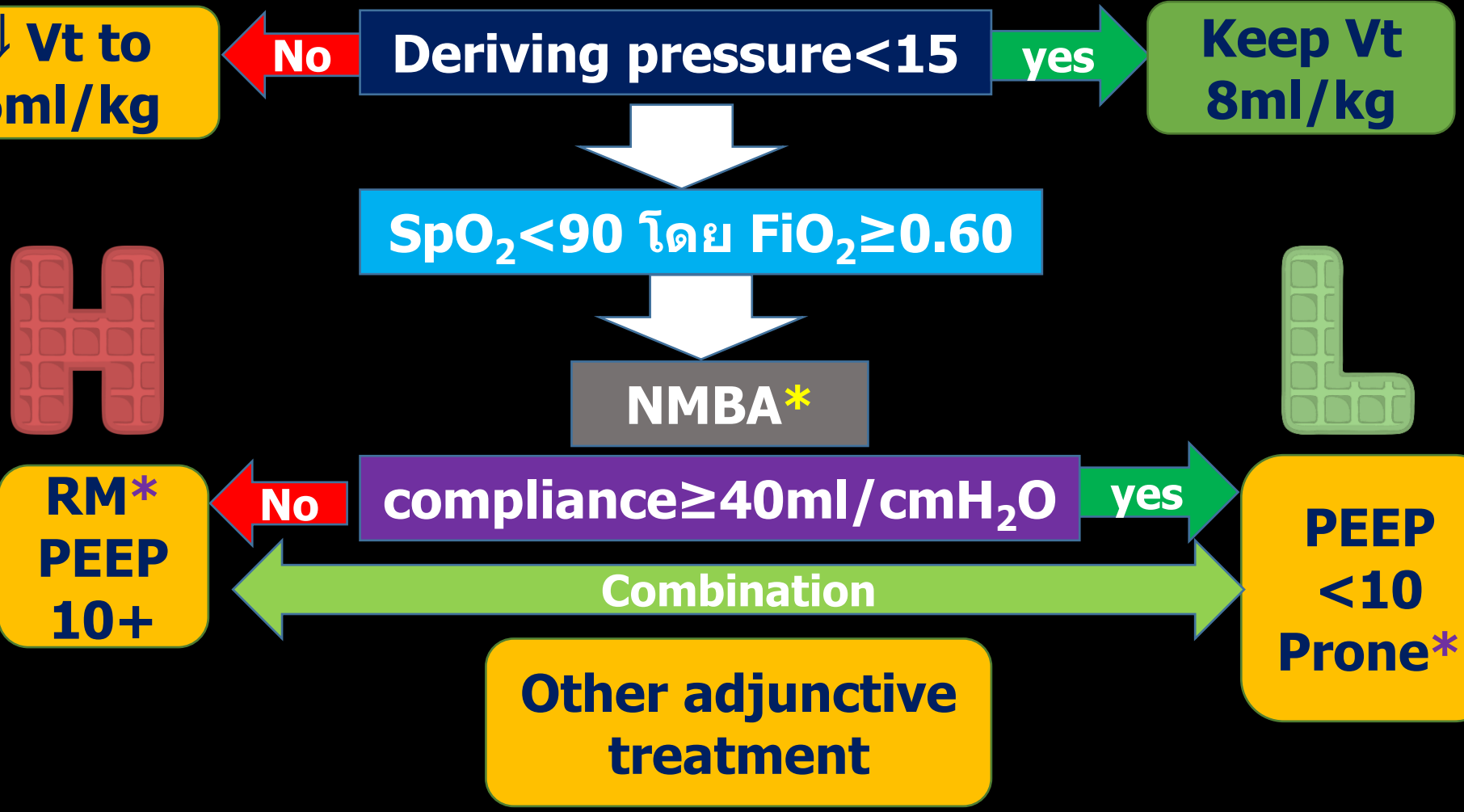
WOB scale≤4*

HFNC
NIV

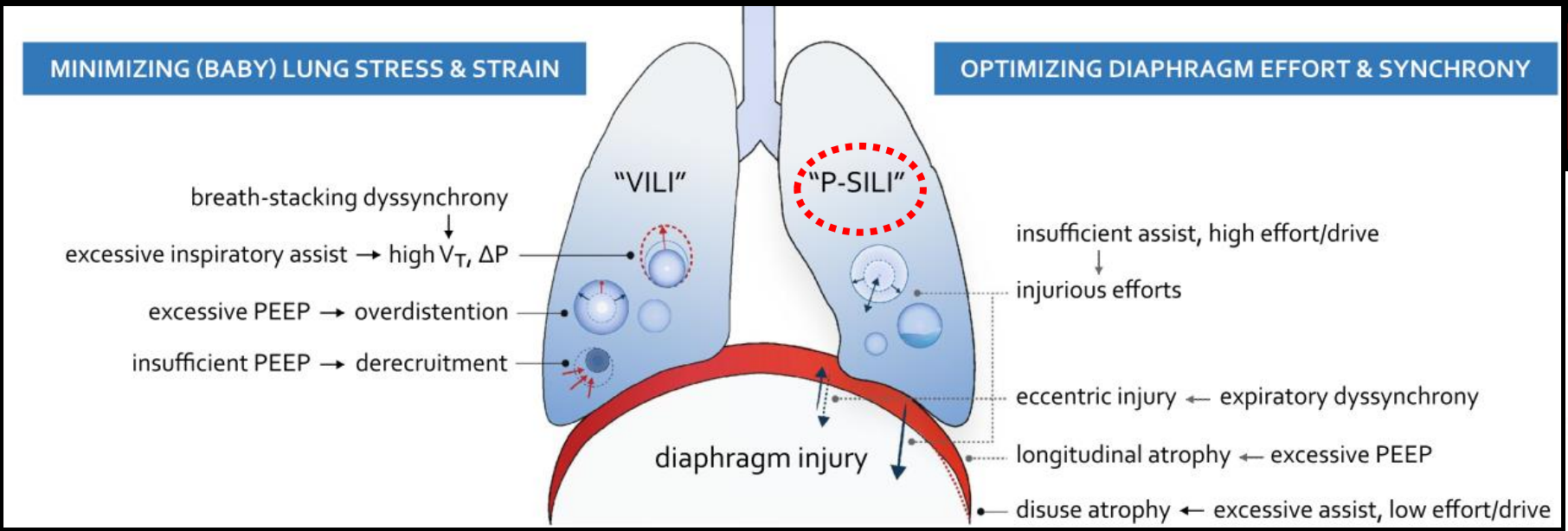
Respiratory care in Covid-19

Assessment of "strain"

Assessment of "L-H type"



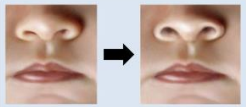
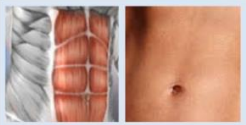
Inspiratory effort : Work of breathing



Parameter	Use	Advantages	Disadvantages	Suggested targets for lung and diaphragm-protective ventilation
Esophageal pressure (Pes) and transpulmonary pressure (P_L)	Directly measure and monitor respiratory effort and tidal lung stress	Minimally invasive Provides gold standard information about lung stress (ΔP_L) and respiratory effort (ΔPes, PTPes)	Requires equipment and training Balloon must be calibrated before each measurement Absolute values of Pes of unclear utility	ΔPes 3–15 cmH_2O (diaphragm protective) $\Delta P_{L,dyn}$ < 15–20 cmH_2O (lung protective)
Diaphragm inspiratory thickening fraction on ultrasound (TFdi)	Non-invasive assessment of diaphragmatic contractility	Provides an index of diaphragmatic effort during mechanical ventilation (tidal TFdi) Provides an index of diaphragmatic function (maximal TFdi)	Requires equipment and training Continuous monitoring is not feasible	TFdi 15–30%

Ewan C. Goligher et al. Intensive Care Medicine · November 2020 DOI: 10.1007/s00134-020-06288-9

Development of a work of breathing scale and monitoring need of intubation in COVID-19 pneumonia

ELEMENT	METHOD	POINTS
 Respiratory Rate	By Counting (bpm)	≤ 20 = 1 21-25 = 2 26-30 = 3 > 30 = 4
 Nasal Flaring (inspiration)	By Observation	1
 Sternocleido-mastoid Use (inspiration)	By Palpation	1
 Abdominal Muscles Use (expiration)	By Palpation	1

Our data suggest that patients with COVID-19 pneumonia can be supported for extended periods using HFNC despite tachypnea provided there is only infrequent and modest use of respiratory accessory muscles, corresponding to a WOB scale ≤ 4, prompting closer assessment for possible intubation when WOB > 4. This

Apigo et al. Critical Care (2020) 24:477
https://doi.org/10.1186/s13054-020-03176-y

Sedative medication in the ICU

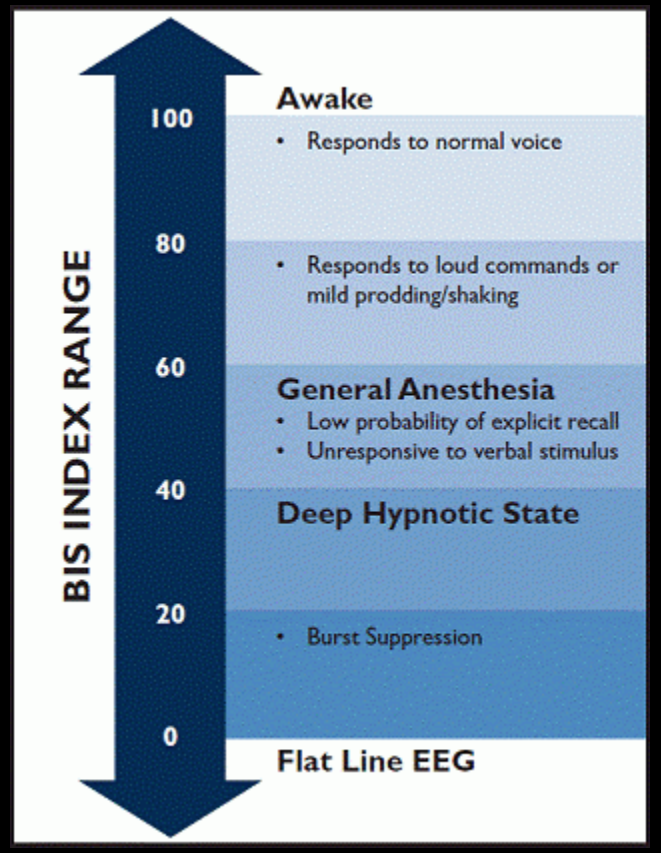
Table 1. Sedatives and Analgesics in Common Use in the ICU.*

Drug (Brand Name)	Mechanism of Action	Typical Adult Dose	Pharmacokinetic Properties	Adverse Effects
Midazolam (Versed) Sedation, amnesia, anxiolysis, seizure control, no analgesia	$GABA_A$ agonist	Bolus, 1 to 5 mg; infusion, 1 to 5 mg/hr	Half-life, 3 to 11 hr; active metabolite accumulates with prolonged infusion; metabolized by hepatic oxidation, with renal excretion of active metabolite	Possibly a higher risk of delirium and tolerance than with certain other sedatives
Propofol (Diprivan) Sedation, anesthesia, seizure control, no analgesia	$GABA_A$ agonist, with other effects, including on glutamate and cannabinoid receptors	50 to 200 mg/hr or 1 to 3 mg/kg/hr	Half-life, 30 to 60 min after infusion; longer after prolonged infusion because of redistribution from fat stores; metabolized by hepatic glucuronidation and hydroxylation	Vasodilatation or negative inotropy causing hypotension or bradycardia; propofol infusion syndrome (lactic acidosis, arrhythmia, and cardiac arrest), mostly associated with prolonged infusion rates of >4 to 5 mg/kg/hr; hypertriglyceridemia; pancreatitis
Dexmedetomidine (Precedex) Sedation, anxiolysis	α_2-Agonist	0.2 to 1.5 μg/kg/hr	Half-life, 2 hr; does not accumulate with prolonged infusion; metabolized by hepatic glucuronidation and oxidation, with no active metabolites	Transient hypertension, then hypotension; bradycardia, dry mouth, nausea
Fentanyl (Sublimaze) Analgesia, sedation, no amnesia	μ-Opioid agonist (also with κ-opioid agonist effects)	20 to 100 μg/hr; loading dose of 50 to 100 μg may be considered	Half-life, 1.5 to 6 hr; highly fat soluble, so rapid onset but accumulates with prolonged infusion; metabolized by hepatic oxidation; no active metabolites	Nausea, constipation, respiratory depression, skeletal-muscle rigidity with high bolus doses
Morphine (Roxanol; Duramorph)	μ-Opioid agonist (also with κ-opioid and δ-opioid agonist effects)	1 to 5 mg/hr; loading dose of 2 to 5 mg may be considered	Half-life, 3 to 7 hr; more water soluble, so slower onset than fentanyl with less accumulation; metabolized by hepatic glucuronidation to morphine-6-glucuronide (10%) (20 times as active as parent drug) and morphine-3-glucuronide (90%) (inactive as an analgesic but causes neuroexcitation, at least in animal models), both with renal excretion	Nausea, constipation, respiratory depression, histamine release and consequent vasodilatation and hypotension, itch

Modified from N Engl J Med 2014; 370:444-454

Sedation monitoring

Bispectral Index Score



Richmond Agitation Sedation Scale

Score	Term	Description
+4	Combative	Overtly combative, violent, immediate danger to staff
+3	Very agitated	Pulls or removes tube(s) or catheter(s); aggressive
+2	Agitated	Frequent nonpurposeful movement, fights ventilator
+1	Restless	Anxious but movements not aggressive or vigorous
0	Alert and calm	
–1	Drowsy	Not fully alert, but has sustained awakening (eye-opening/eye contact) to voice (>10 seconds)
–2	Light sedation	Briefly awakens with eye contact to voice (<10 seconds)
–3	Moderate sedation	Movement or eye opening to voice (but no eye contact)
–4	Deep sedation	No response to voice, but movement or eye opening to physical stimulation
–5	Unarousable	No response to voice or physical stimulation

Commonly Used NMBAs in the ICU

NMBA Agent	Pancuronium	Vecuronium	Rocuronium	Atracurium	Cisatracurium	Succinylcholine
NMBA Type	A	A	A	B	B	D
Category (acting)	Long acting	Intermediate	Intermediate	Intermediate	Intermediate	Short
Time to maximal blockade (min)	2–3	3–4	1–2	3–5	2–3	< 1
Duration of action (min)	60–100	20–35	20–35, 60–80 with rapid sequence dose	20–35	30–60	5–10
Dose						
Bolus	0.05–0.1 mg/kg	0.08–0.1 mg/kg	0.6–1 mg/kg (1–1.2 mg/kg for rapid sequence)	0.4–0.5 mg/kg	0.l–0.2 mg/kg	1 mg/kg, dose higher in pediatrics
Continuous infusion dosing	0.8–1.7 mcg/kg/min	0.8–1.7 mcg/kg/min	8–12 mcg/kg/min	5–20 mcg/kg/min	1–3 mcg/kg/min	Infusions no longer used commonly
Elimination	45–70% renal, 15% hepatic	10–50% renal, 35–50% hepatic	33% renal, < 75% hepatic	5–10% renal, Hoffman elimination	5–10% renal, Hoffman elimination	Plasma cholinesterase
Active metabolites	3-OH and 17-OH pancuronium	3-Desacetyl-Vecuronium	None	None (toxic metabolite-laudanosine)	None	None
Side effects	Vagal blockade, sympathetic stimulation, blocks muscarinic stimulation (bradycardia)	Vagal blockade at higher doses	Vagal blockade at higher doses, weakly blocks muscarinic stimulation (bradycardia)	Histamine release, minimal ganglionic blockade	None	Minimal amount of histamine release, muscarinic stimulation (bradycardia)

Crit Care Med 2013; 41:1332–1344

Prone position

Possible Contraindications

Absolute; Multiple trauma, open abdomen or chest, pelvic external fixation, Spinal/Vertebral instability
Relative; Raised Intra-ocular or intracranial pressure, 2nd or 3rd pregnancy trimester, frequent seizures, obesity, CVS instability, pelvic or chest fractures, recent abdominal surgery

intensive care society

Visualise!

- You must be able to suction the airway and visualise the ET and Tracheostomy tube at all times
- Arms in 'front crawl' swimming position and alternated 2 hourly at the same time as head reposition

STANDARD CARE	
1	Plan ahead - make sure that all necessary investigations have been carried out, timing of procedure to turn patient prone and back to supine position, gather all necessary equipment including re-intubation and airway trolley.
2	Ensure the completion of a pre proning checklist to maintain patient safety
3	Ensure appropriate number of staff are available (minimum 5), including staff competent in advanced airway skills. Allocate roles.
4	Complete a post proning checklist and debrief

Post Proning Nursing Checklist

https://www.youtube.com/watch?v=JrVPU5QLkf0

Area	Check Point	Checked --Initial--
Head/Face	Check ETT/tracheostomy is accessible/not kinked (ETT cm at teeth …..)	
	All connections between ETT and ventilator circuit secure	
	Note ETT/tracheostomy cuff pressure	
	ETT positioned in middle of mouth, not compressing lips	
	Dermal gel pads placed between ETT cotton ties and patient's skin	
	Confirm ears are not bent over	
	Perform ETT/tracheal suctioning immediately post proning	
	Eyes taped shut	
	No direct pressure on the eyes	
	Ensure 30° foot down positioning (Reverse Trendelenburg)	
	Move patient's head from side to side 2 hourly to relieve pressure	
	NG tube secure and not displaced (cm at nose=…..)	
	NG tube not causing pressure to nostril	
Neck	Verify that patient's lower back and neck are not hyper-extended	
	Front of neck free from compression	
	Central line secure	
Chest	Chest drains patent and on correct suction	
	Breasts supported and free from pressure	
Abdomen	Abdomen free	
Pelvis	Pelvis support cushion in place	
	Male genitalia positioned between legs	
	Catheter tubing is free and between legs	
Arms	Placed by side of patient	
	Shoulders not rotated	
	No compression over elbows	
	Wrists in neutral position	
	Hands free	
	Alternate Swimmers Position 2-4 hourly	
	No peripheral IV lines under patient	
Legs	Pillows positioned under shins to prevent extension	
Infusions/Monitoring	All monitoring recommenced	
	All infusions connected and infusing	
	Check CRRT lines patent	
	ECG leads not underneath patient	
	Ensure patient is well sedated and pain free	
	Infusion lines not resting on patient's skin	
	Mattress is in dynamic mode	
	Check ABG 20-30 mins post prone positioning	

Appendix 1. LocSSIP PROCEDURE SAFETY CHECKLIST: Prone Ventilation in Critical Care

BEFORE THE PROCEDURE		
Have all members of the team introduced themselves?	Yes	No
Consultant/Senior nurse aware	Yes	No
Any contraindications	Yes	No
Re-intubation equipment available	Yes	No
Eyes taped and lubricated	Yes	No
ETT taped/tied (ETT anchor devices removed)	Yes	No
Stop NG feed and aspirate NGT	Yes	No
Non-essential monitoring + infusions discontinued	Yes	No
Adequate length on remaining lines going either up or down bed	Yes	No
Chest drains below patient/clamped only if safe to do so.	Yes	No
Assess and document skin integrity	Yes	No
Anti-pressure dressings to bony prominences/nipples	Yes	No
Daily hygiene completed (ie. mouthcare/washing/dressings etc.)	Yes	No
Equipment available as per guideline	Yes	No
Are there any concerns about this procedure for the patient?	Yes	No
Concerns		

PaO2/FiO2 Ratio	
Grade Laryngoscopy	
Length ETT at teeth	
Length NGT at nostril	
Airway Doctor	
Consultant in charge	

TIME OUT Verbal confirmation between team members before start of procedure		
Minimum of 5 people plus 1 for chest drains	Yes	No
All team members aware of role	Yes	No
Appropriate ventilator settings	Yes	No
Cardiovascular stability	Yes	No
Adequate sedation (ie. RASS -5)	Yes	No
Adequate muscle relaxation – consider need for bolus	Yes	No
Pillows positioned correctly – chest, pelvis, knees	Yes	No
Team members familiar with procedure	Yes	No

Patient Sticker

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SIGN OUT		
ETT length at teeth/Capnography	Yes	No
Monitoring re-established	Yes	No
Ventilator settings reviewed	Yes	No
Lines secured	Yes	No
Chest drains below patient + unclamped		
Pressure areas checked - ETT not pressing against lips - No pressure on eyes - Ears not bent over - NG not pressed against nose - Penis between legs + urinary catheter secured - Lines / tubing not resting against skin - Pillows positioned correctly	Yes	No
Slide sheet removed and reverse trendelenburg 30 °	Yes	No
NG position confirmed and resume enteral feed	Yes	No
Post-proning care bundle available	Yes	No

Signature of responsible person completing the form	
Procedure Date + Time	

SAFE PRONE CHECKLIST

PATIENT LABEL HERE

Date: ____/____/____ Shift: ____Time of pronation: ____:____ Time of return to supine position: ____:____

Perform the activities below, according to the abbreviations: TEC (nursing technician), NUR (nurse), FHY (physical therapist), DOC (physician)

PRE-MANEUVER - TIME IN

Diet

- ☐ TEC: Suspend and open NET in bottle 2 hours before Time for the diet break: _____h

Materials

- ☐ NUR/PHY: Provide cushions ***Making: pyramidal pillow + 2 sheets + pillow slip held together with adhesive tape.***
- ☐ TEC: Place crash cart and intubation nearby
- ☐ TEC: Test aspiration equipment and ambu

Care

- ☐ TEC: Perform eye care (hydration and occlusion) Skin care: hydrocolloid in ( ) face, ( ) chest, ( ) iliac crest, ( ) knee, ( ) _____
- ☐ NUR: Review fixation of invasive and curative devices. ***Review extensor length***
- ☐ NUR: Suspend continuous hemodialysis, recirculate and heparinize catheter

Airway

- ☐ TEC: Aspirate AS and ETT or TCT
- ☐ NUR: Check cord fixation, record mouth corners and ETT cuff pressure
- ☐ DOC/PHY: Pre-oxygenate (FiO_2:100% for 10 minutes)

Analgesia and sedation

- ☐ DOC: Evaluate need for increased sedation and curarization (evaluate BIS value)

PERFORMANCE OF MANEUVER

Records

- ☐ TEC: BIS, vital signs, MV parameters

Preparation for maneuver

- ☐ NUR: Position MAP electrodes and transducer in ULs and align monitoring and oximetry cables
- ☐ TEC: Disconnect BIS, NET bottle, aspirator
- ☐ TEC: Clamp tubes and drains **except the chest drain** and place between the patient's legs or arms

Performance of the maneuver

- ☐ TEC: Place headboard in flat position and align limbs
- ☐ NUR/PHY: Place the cushions on the pelvis and chest
- ☐ TEC: Place the bed sheet over the patient
- ☐ TEC: Suspend infusions and disconnect ***(maintain only vasopressor and PTN)***
- ☐ TEC/NUR/PHY: Form the ENVELOPE ***(wrap the edge of the sheets as closely as possible to the patient's body)***
- ☐ Perform the maneuver ***(do not forget the 3 turning points)***

Adverse events

ATTENTION:

NO X-RAY IN PRONE POSITION.

In case of a chest tube: DO NOT CLAMP THE CHEST TUBE!

POST-MANEUVER - TIME OUT

Positioning

- ☐ DOC: Confirm ETT or TCT position
- ☐ NUR/PHY: Place face cushion
- ☐ TEC 1: Restart infusions
- ☐ NUR: ***Place MAP transducer (review point ZERO)***
- ☐ TEC 1: Place electrodes on the back
- ☐ TEC 2: Place tubes and drains and open clamps
- ☐ NUR/PHY: Elevate upper limb into swimmer's position
- ☐ TEC/PHY: Place the remaining cushions (hand, below and above the knee)
- ☐ TEC: Reverse Trendelemburg ***(raise headboard as high as the bed allows)***

Care

- ☐ NUR: Restart continuous hemodialysis if hemodynamic and ventilatory stability is maintained
- ☐ NUR/TEC/PHY/DOC: Alternate swimmer's position every 2 hours
- ☐ TEC: Relieve pressure points
- ☐ TEC: BIS, vital signs, MV parameters, mouth corners, cuff pressure and intercurrences

Diet

- ☐ NUR: Restart diet after 1 hour (30mL/hour or according to medical assessment) if there are no intercurrences
  Time of diet restarted: _____h
- ☐ TEC: Observe tolerance to diet and progress: 40mL/hour after 6 hours and 50mL/hour after 12 hours in prone

TEAM ORGANIZATION

STEP 1 – TIME and TEAM definition

⇨ The physician decides for the prone position and agrees with nurse and physical therapist the time for implementing the maneuver. The nurse decides the participating team (**6 members:** 1 physician, 1 physical therapist, 1 nurse and 2 technicians; the sixth participant will be only responsible for checklist).

Duties during the maneuver:

Nurse: invasive MAP/withholding drugs/revising diet

Physician: care of the OTT during the maneuver and post-maneuver checking

Physical therapist: tube suction

Technician 1: removing and replacing electrodes

Technician 2: clamping and releasing tubes

ATTENTION: In case of a **chest tube**, the team should have **one additional** member responsible for the care of the chest tube and respective bottle.

DO NOT CLAMP THE CHEST TUBE!

STEP 2 – Provide pillows (responsible: physical therapist)

STEP 3 – Pre-maneuver care (responsible: nurse)

STEP 4 – Team reunion for executing the maneuver

⇨ At the time scheduled, the team should gather: the physician takes position at the head of the bed, the nurse and the physical therapist by both sides of the patient's torso, and two technicians. A team member not involved in the maneuver should checklist the entire procedure.

⇨ **The time-in (pre-maneuver care) should be checked with all team members reunited, although the execution should had been previously performed.**

⇨ **In case of cardiorespiratory arrest, resuscitate the patient in prone position!**

RECORDS

ARTERIAL GAS COLLECTED

	Supine position (before prone)	1 hour in prone position	6 hours in prone position	End of prone position	4 hours in supine position	12 hours in supine position
PaO_2						
$PaCO_2$						
pH						
$SatO_2$						
FiO_2						

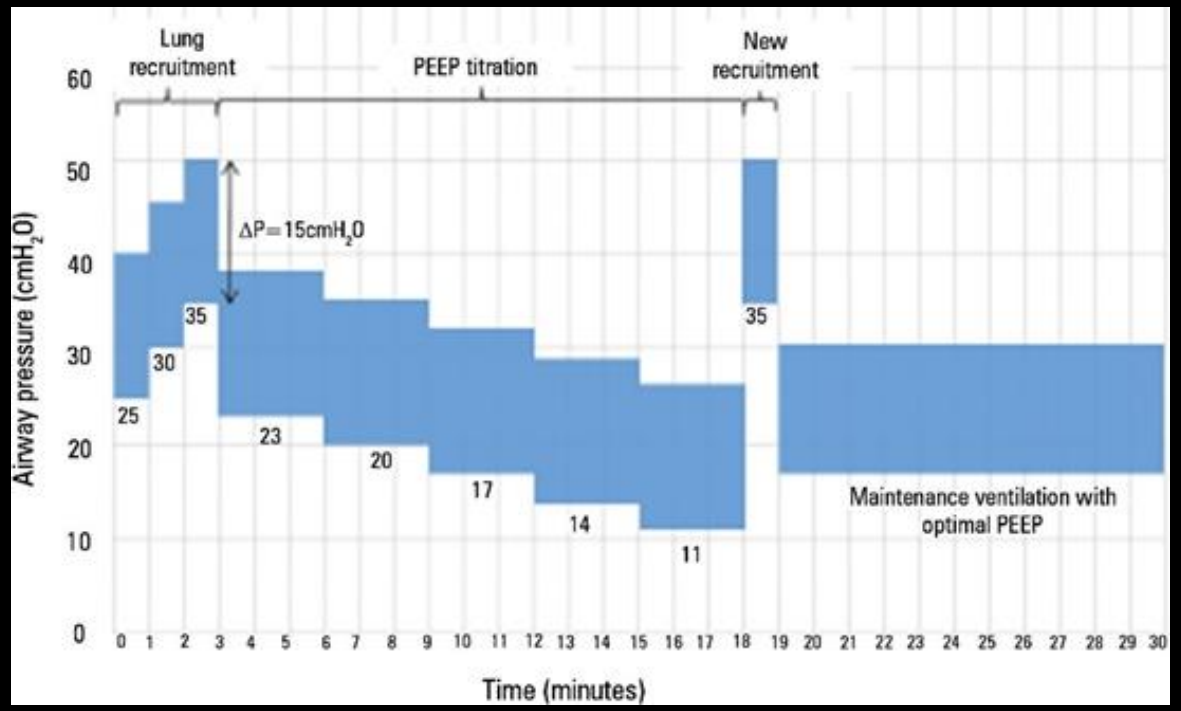
VENTILATORY MECHANICS

	Supine position	1 hour in prone position	End of prone position	4 hours in supine position
peakp				
platp				

Recruitment Maneuver

Contraindications

- Circulatory instability
- Pneumothorax or other air leaks
- High risk of pneumothorax
- ⇑ICP

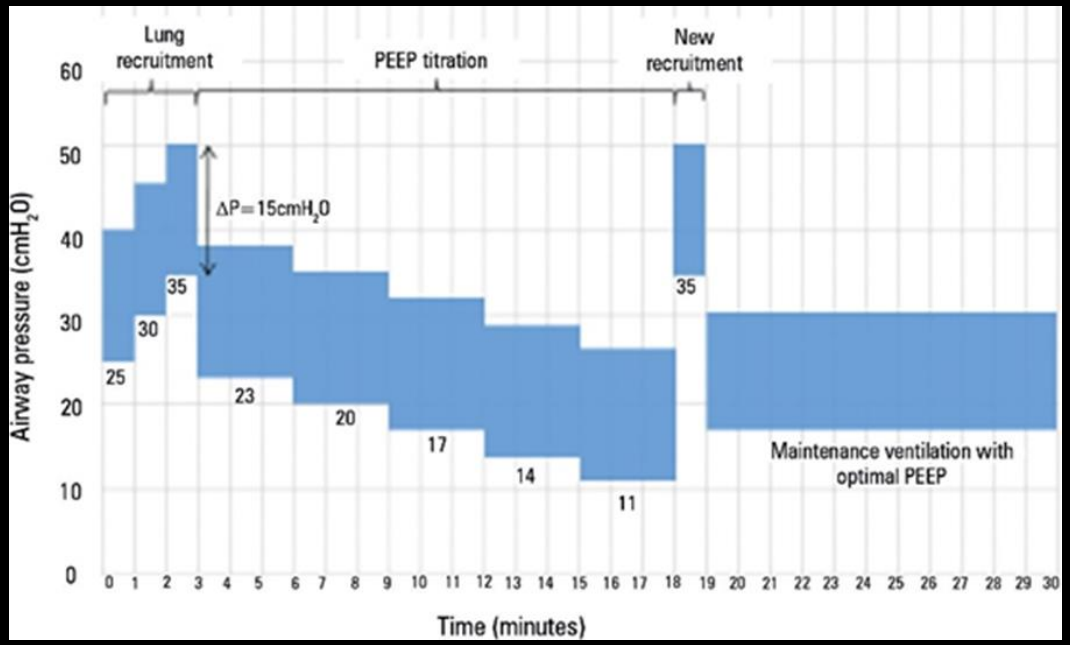


Monitoring during RM

- HR
- BP
- SpO_2
- Vt
- RS compliance
- Lung sound or U/S

RM should be stopped if:

- HR < 60 or > 140/min
- new dysrhythmia
- SBP <80 mmHg
- SaO_2 < 85%



"Best PEEP" Compromise Strategy

- Minimize effort and ventilation demand
- Choose the VT or driving pressure to be used in practice (e.g., 6 ml/kg)
- Use least acceptable FiO_2 to keep $SaO_2 \approx 92\%$
- Perform a recruiting maneuver using escalating PEEP to 50-60 mH_2O peak pressure (5 breaths at each PEEP level)
- Drop PEEP abruptly from its highest value to 20 cmH_2O and drop PEEP further in small steps every 2 min until O_2 sat falls or driving pressure rises.
- Re-Recruit and drop PEEP to that value plus one step

John J. Marini, Focus Pittsburgh September 28, 2017

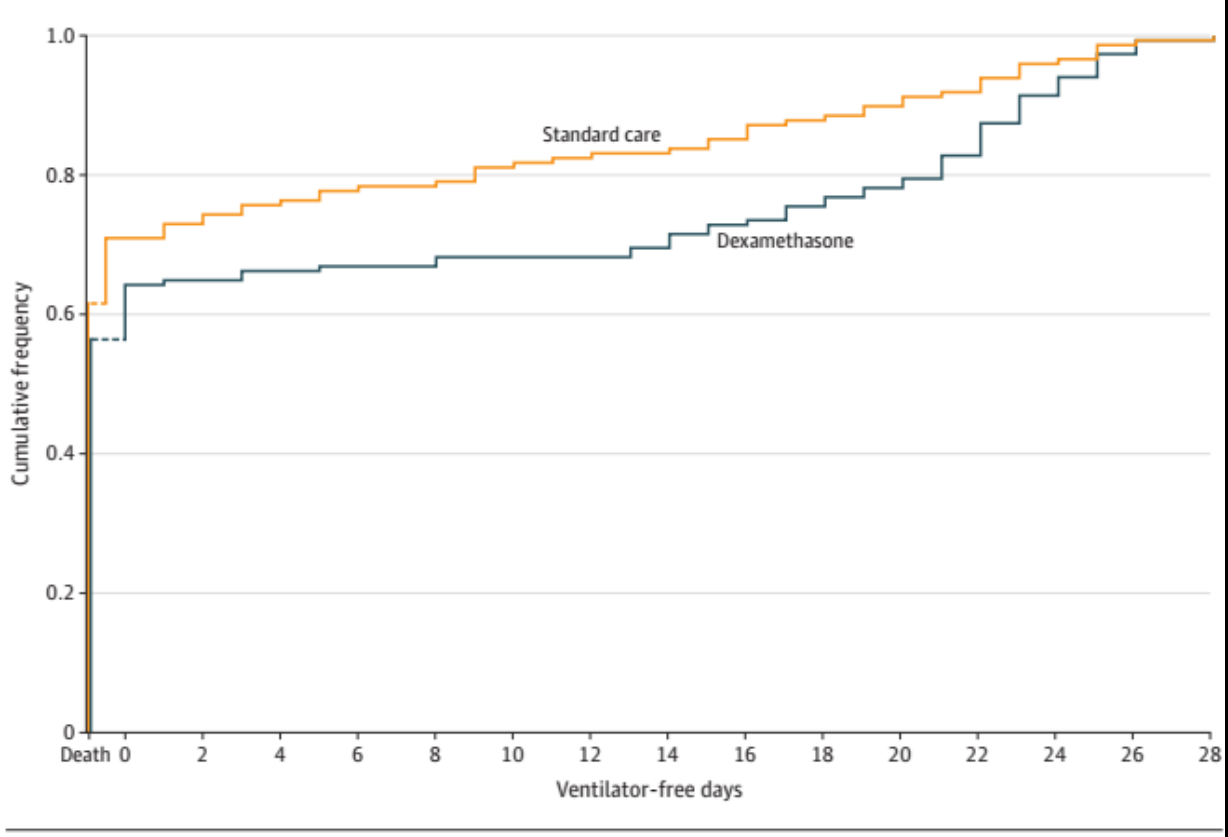
Corticosteroid

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Dexamethasone on Days Alive and Ventilator-Free in Patients With Moderate or Severe Acute Respiratory Distress Syndrome and COVID-19

The CoDEX Randomized Clinical Trial

JAMA. 2020;324(13):1307-1316. doi:10.1001/jama.2020.17021
Published online September 2, 2020.



20 mg of dexamethasone intravenously daily for 5 days, 10 mg of dexamethasone daily for 5 days or until ICU discharge, plus standard care

The dashed lines represent patients who died (assigned 0 ventilator-free days), Solid lines show the cumulative frequency of patients who were receiving mechanical ventilation all 28 days

CONCLUSIONS AND RELEVANCE Among patients with COVID-19 and moderate or severe ARDS, use of intravenous dexamethasone plus standard care compared with standard care alone resulted in a statistically significant increase in the number of ventilator-free days (days alive and free of mechanical ventilation) over 28 days.