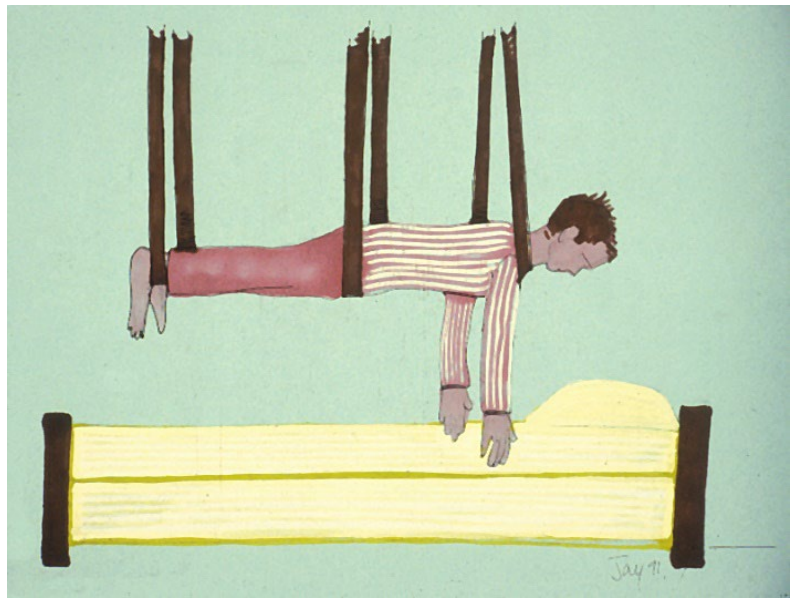
Upside Down You Turn Me: When Why and How of Prone Positioning for ARDS Patients



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ADVANCING NURSING THROUGH KNOWLEDGE & INNOVATION

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Objectives

- Discuss the physiologic rationale and the evidence for use of the prone position in patients with ARDS
- Identify evidence-based strategies for determining when to turn, how to turn, and how long to allow patients to remain in the prone position
- Outline strategies for preventing complications during turning and while in the prone position

Prone Positioning Incidence

Prone positioning (PP) was only used in 16.3% of patients with severe ARDS in the LUNG SAFE study

Bellaini G, et al. JAMA, 2016;315(8):788-800

European Prevalence Study (APRONET): Use of PP in mild 5.9%, moderate 10.3%, severe 32.9% ARDS

Guerin C, et al. Intensive Care Med, 2018;44(1):22-37

Italy and Netherlands—60% of Mechanical Ventilated ARDS COVID 19 patient were proned, 50% in the US

Stilma W, et al. *J Clin Med*. 2021;10(20):4783.
Langer T, et al. *Crit Care* 2021; **25:**128
Mathews KS, et al. Crit Care Med. 2021;49(7):1026-1037.

The Berlin ARDS Definition

TIMING	Within 1 week of a known clinical insult or new/worsening respiratory symptoms
CHEST IMAGING (X-RAY OR CAT SCAN)	Bilateral opacities—not fully explained by effusions, lobar/lung collapse, or nodules
ORIGIN OF EDEMA	Respiratory failure not fully explained by cardiac failure or fluid overload; need objective assessment (eg, echocardiography) to exclude hydrostatic edema if no risk factors present

	MILD	MODERATE	SEVERE
OXYGENATION	<200 PaO_2/FiO_2 or ≤300 with PEEP/CPAP ≥5 cm H_2O	<100 PaO_2/FiO_2 or ≤200 with PEEP ≥5 cm H_2O	≤100 PaO_2/FiO_2 with PEEP ≥5 cm H_2O
MORTALITY	27% (24% to 30%)	32% (29% to 34%)	45% (42% to 48%)

Ferguson ND, et al. *Intensive Care Med*. 2012;38(10):1573-1582.

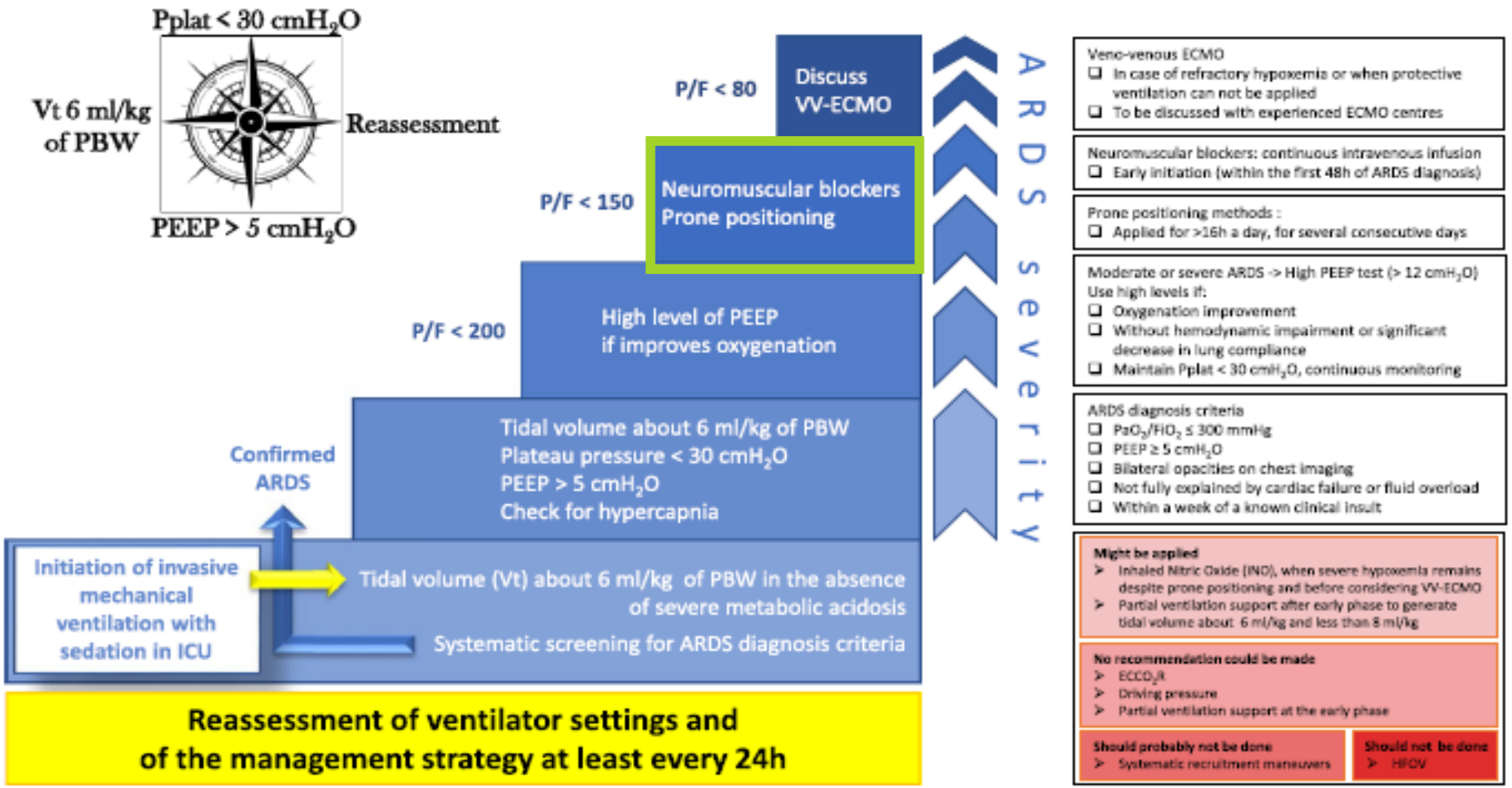
A New Global Definition of ARDS

ARDS New Global Definition 2023

● new definition criteria	Classification		
	Mild	**Moderate**	**Severe**
Time to instalation	Up to seven days - known risk fator(s)		
Pulmonary edema	Not explained by cardiogenic edema or intravascular volume overload		
Radiologic features	Bilateral infiltrates on chest X-ray or CT or lung ultrasound (by a trained professional) (not explained by nodules, pleural effusion or atelectasis)		
Hypoxemia **PaO_2/FIO_2****	201-300 with NIV/CPAP PEEP ≥ 5* **or HFNO > 30l/min**	101 - 200 com PEEP ≥ 5	≤ 100 com PEEP ≥ 5
Hypoxemia **SpO_2/FIO_2**	**≤ 315 with SpO_2 ≤ 97%**		

Am J Respir Crit Care Med 2023;207:A6229

Early management of ARDS in 2019



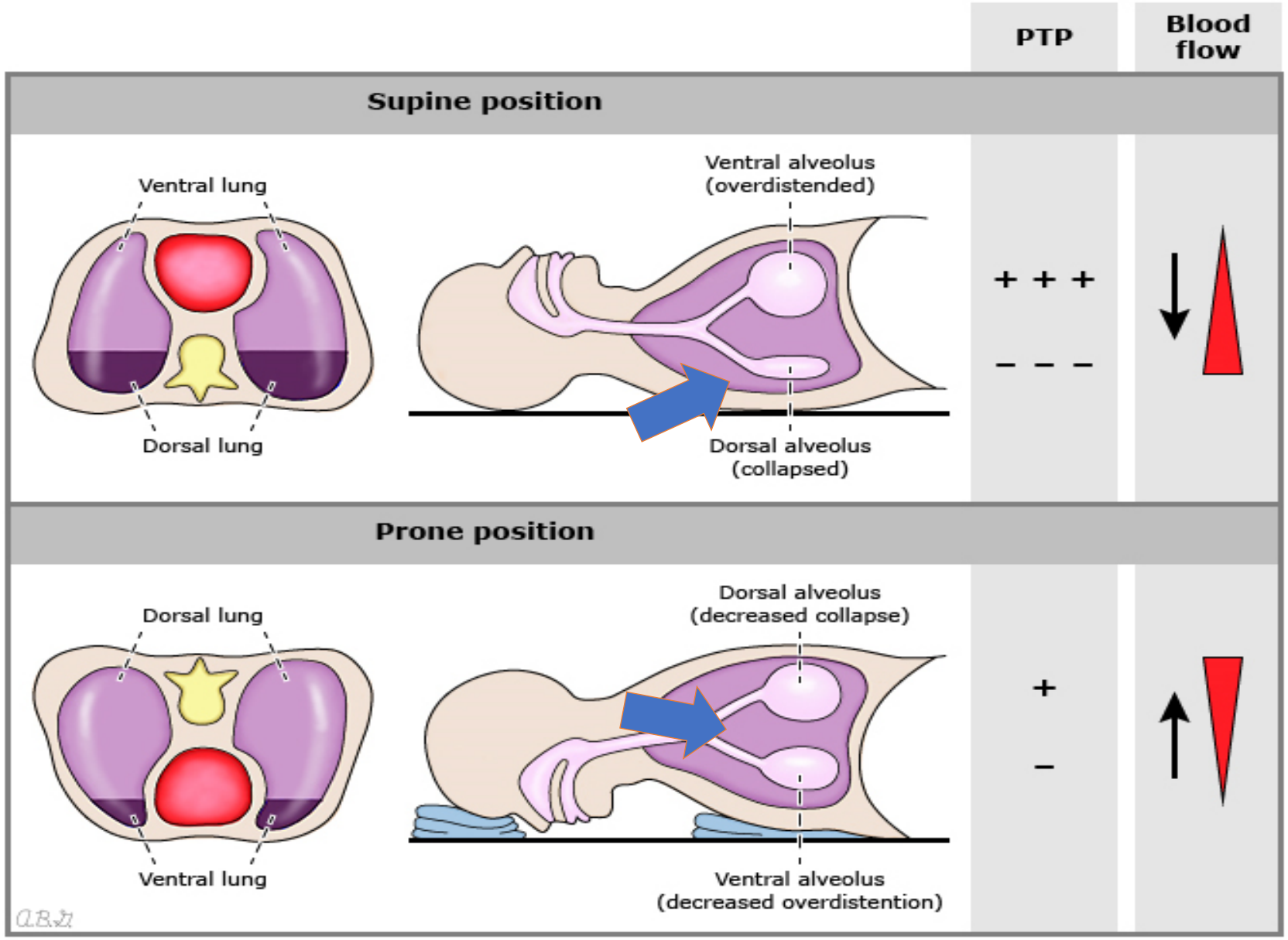
Papazian L, et al. Ann Intensive Care, 2019;9:69

Why Prone Positioning?[1-2]

- Improves dependent aeration recruiting alveoli
- Reduces hyperinflation of nondependent regions dramatically
- Results in more homogenous lung aeration which reduces regional shear strain…less ventilator-induced lung injury (VILI)
- Decreases barotrauma and atelectrauma by recruiting and reducing overdistension that occurs with higher positive end-expiratory pressure (PEEP)
- ↓ PACO2 relates to net increase in recruitment /↓ in dead space
- Drains secretions

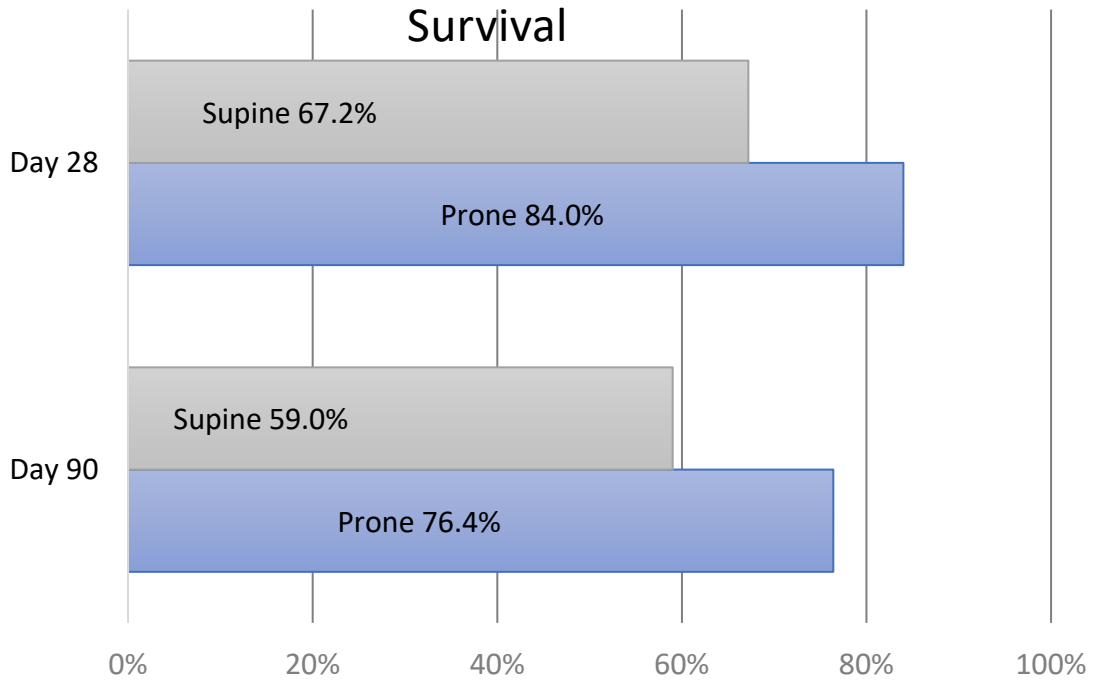
1. Scholten EL, et al. *Chest*. 2017;151(1):215-224

2. Gattinoni J, et al. Semin Resp Crit Care Med, 2019;40:94-100.



https://www.uptodate.com/contents/prone-ventilation-for-adult-patients-with-acute-respiratory-distress-syndrome/print

Proning Severe ARDS Patients



In a randomized, controlled trial of 466 patients with severe ARDS, survival was significantly higher at 28 and 90 days in the prone position group

NNT=6

Guerin C, et al. *N Engl J Med*. 2013368(23):2159-2168.

Prone Positioning Meta-Analysis

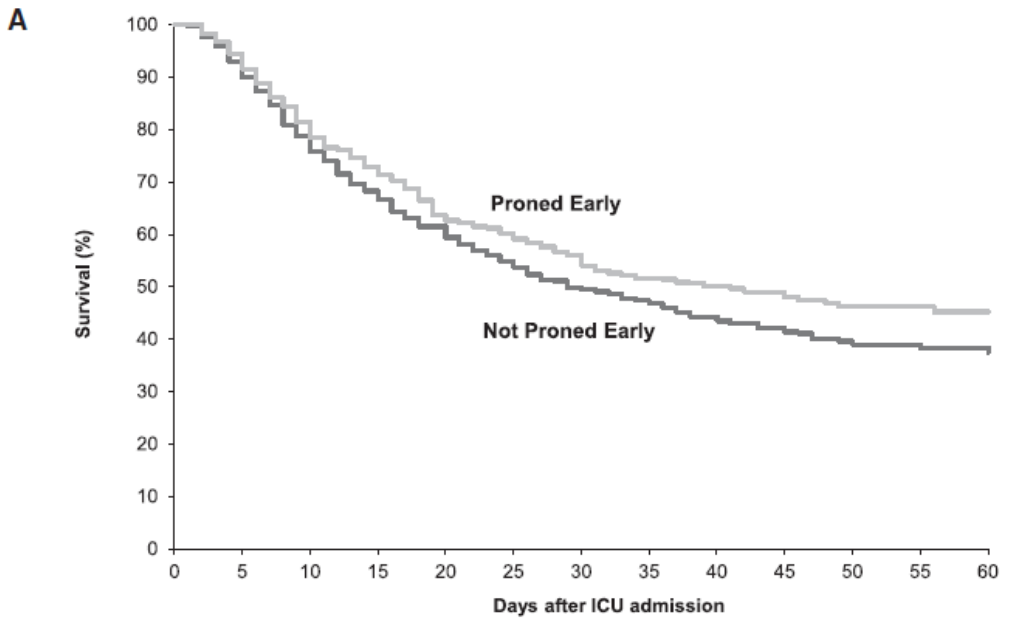
9 randomized controlled trials / 2,242 patients

OUTCOMES	DECREASED 30-DAY MORTALITY	REDUCED 60-DAY AND 90-DAY MORTALITY	REDUCED 28-30-DAY MORTALITY
PATIENT POPULATION	ARDS patients with a PaO_2/FiO_2 ratio ≤100 mmHg	ARDS patients ventilated with PEEP ≥10 cmH_2O	ARDS patients who had duration of proning >12 hours per day (n = 1,067, RR = 0.73, 95% CI = 0.54 to 0.99; P = 0.04)

Hu SL, et al. *Crit Care*. 2014;18(3):R109.

Prone Positioning in COVID 19 Patients

- Data from Study & Treatment of Outcomes in Critical Ill Patients with COVID 19
- 68 hospitals (March 2020 to May 2020)
- Mechanical ventilated pts with P/F ratio < 200mmHg initiated prone positioning or not within first 2 days of ICU admission
- Results
  - 2338 eligible pts: 30% proned
  - Lower in-hospital mortality if proned early
  - 19.5% proned later in the course of illness



No. at risk

	Day 0	Day 10	Day 20	Day 30	Day 40	Day 50	Day 60
Proned	702	566	387	243	126	59	22
Not Proned	1636	1258	755	421	215	105	52

Mathews KS, et al. Critical Care Medicine, 2021;49(7):1026-1037

ESICM ARDS 2023 Guidelines Update

- We **recommend** using prone position as compared to supine position for patients with moderate-severe ARDS (defined as PaO2/FiO2 < 150 mmHg and PEEP ≥ 5 cmH2O, despite optimization of ventilation settings) to reduce mortality. (*Strong recommendation, high level of evidence in favor)*
  - ARDS
  - COVID ARDS

Grasselli, G., Calfee, C.S., Camporota, L. *et al.* ESICM guidelines on acute respiratory distress syndrome: definition, phenotyping and respiratory support strategies. *Intensive Care Med* **49**, 727–759 (2023).

Case Study

- Mr. Green is a 65-year-old male 90kg male 5 feet 10 inches. Patient has a 2-day history of fever and chills. His past medical hx is hypertension and coronary artery disease. He presents to the Emergency room with a fever 39.5°C complaining of inability to catch his breath.
- His initial vital signs:
  - HR 120/min
  - RR 40/min
  - BP 90/65
  - O2 sat of 92% on room air.
  - He is placed on 50% HFNC
  - ABG: (On 50% HFNC)
    - pH 7.20
    - PaCO2 28,
    - PaO2 60,
    - SaO2 93%
    - Bicarb 13
  - Extremely labored breathing
  - Change in LOC
  - Lactic acid: 3.5
  - WBC's: 24,000 with a left shift
  - Platelets: 75,000
  - Electrolytes WNL
  - Chest x-ray shows bilateral infiltrates

What should happen next?

Polling Question

- What should be the next step in Mr. Green's care?
  1. Initiate non-invasive ventilation
  2. Initiate intubation
  3. Change to 100% non-rebreather

Case Study

- Intubated and transferred to the ICU
- Settings on mechanical ventilation
  - Vt 528, AC 28, FiO2 of 1.0, PEEP 8cm, Plat pressures 38cm H20
- ABG's: 7.34, 35, 70, 94, 18
  - P/F ratio is 70
- PEEP increased incrementally over next 12 hours to 14cm
- FiO2 at 80%
- Plateau pressures 35cm H2O mmHg

- ABGs:
  - Ph 7.35
  - PaCO2 34
  - PaO2 60
  - SaO2 91
  - Bicarb 20
  - P/F ratio 75

What should be our next step?

Polling Question

- What should be the next step in Mr. Green's care?
  1. Switch to High Frequency Oscillation Ventilation (HFOV)
  2. Initiate Extra Corporeal Membrane Oxygenation (ECMO
  3. Initiate prone positioning
  4. Switch to Airway Pressure Release Ventilation (APRV)

Who to Place in Prone Position?

- We **recommend** starting prone position in patients with ARDS receiving invasive mechanical ventilation early after intubation, after a period of stabilization during which low tidal volume is applied and PEEP adjusted and at the end of which the PaO2/FiO2 remains < 150 mmHg; and proning should be applied for prolonged sessions (16 consecutive hours or more) to reduce mortality.
  - Strong recommendation; high level of evidence in favor.

Grasselli, G., et al. *Intensive Care Med* **49**, 727–759 (2023).

Who Not to Place in Prone Position? Absolute Contraindications

1. Patients with facial/neck trauma or spine instability
2. Goals of Care: Allow for a natural death (comfort care)

Guérin C, et al. Intensive care medicine, 2020; 46(12), 2385–2396.

Relative Considerations

- Uncontrolled intracranial pressure or poorly controlled seizures
- Massive bleeding /hemoptysis
- Venous thrombosis treated < 48 hours
- Increased intracranial pressure
- Patient with hemodynamically unstable condition (as defined by a systolic blood pressure <90 mm Hg or MAP < 60) with fluid and vasoactive support in place
- Unstable chest wall, open abdomen
- Burns > 20% of the ventral body surface
- Cardiac abnormalities: life threatening arrhythmias, ventricular assist devices, intra-aortic balloon pump, ECMO, fresh pacemaker
- Bronchopleural fistula, Unstable airway, tracheal surgery within 2 weeks
- Pregnancy second or third trimester or extremely distended abdomen (padding above and below this distention may offset unnecessary pressure)
- Weight 160 kilograms or greater (weigh the risk benefit ratio for the patient and staff)
- Advanced arthritis

Guérin C, et al. Intensive care medicine, 2020; 46(12), 2385–2396.

Patients Who Have Been Placed in the Prone Position Successfully

1. Patients with open abdomens
2. Patients with intracranial pressure monitoring
3. Patients with hemodynamic instability
4. Patients with pelvic fractures
5. Patients with external fixators
6. Patients with multiple traumatic injuries
7. Patients with use of extracorporeal membrane oxygenation (ECMO)
8. Patients with continuous renal replacement therapy (CRRT)

Patients with morbid obesity

Mitchell DA, et al. AACN Advanced Critical Care, 2018;29(4):415-425

Pre-Prone Position Process[1-4]

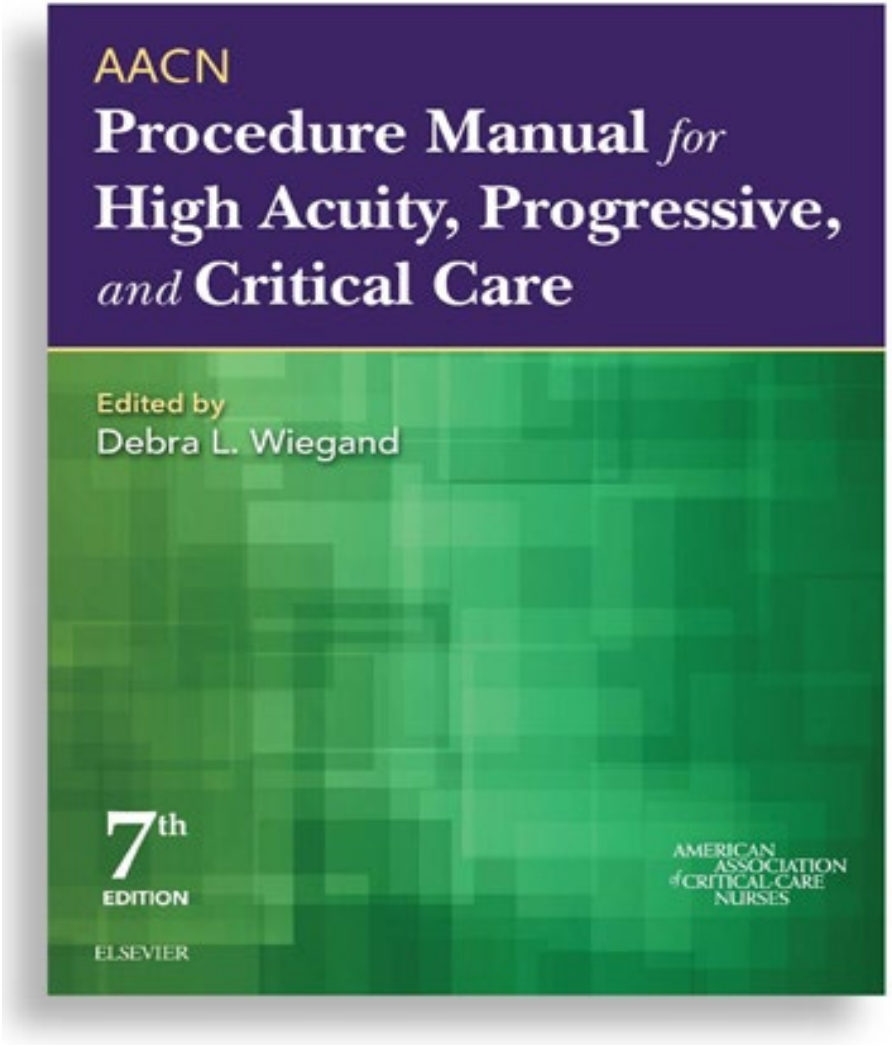
- Patient and family education
- Gather staff (5) and supplies, obtain pre prone measurements
- Preoxygenate, consider hold to empty stomach (1hr) if TF rate is high
- Suction endotracheal tube (if applicable)/oral cavity,
- Secure the endotracheal tube and lines (remove ET holders if in use)
- Position tubes inserted above the waist to the **top of the bed**
- Position tubes inserted below the waist to the **foot of the bed** (except chest tubes)
- Empty ileostomy/colostomy bags before the turn
- Perform eye care
- Placement of prophylactic dressings in high pressure/shear risk areas (forehead, chin, chest, elbow, pelvic, knees, dorsal feet)
- Ensure the tongue is inside patient's mouth
- Consider capnography monitoring
- Develop an exit strategy for instability while in the prone position

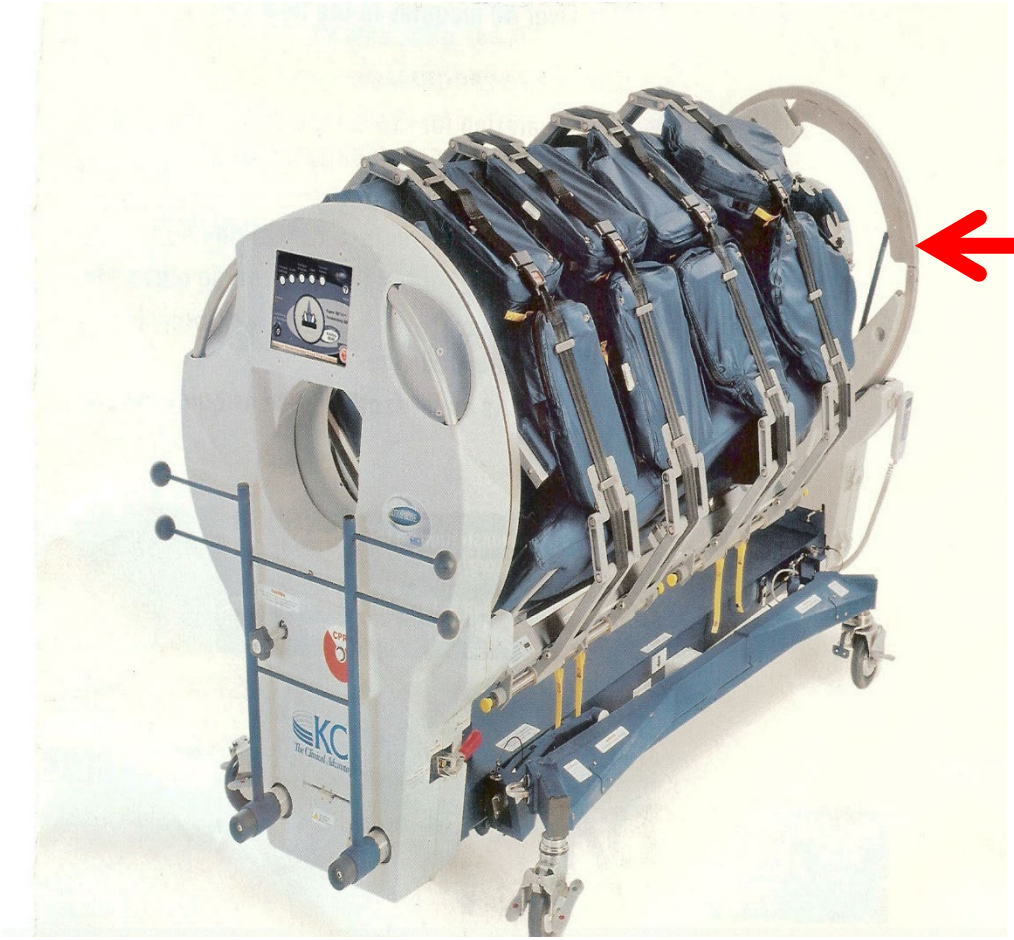
1.Vollman KM, et al. AACN Procedural Manual. 2016:142-163
2. FICM Guidelines for Prone Position in Adult Critical Care 2019 accessed 5/08 /2021
https://www.ficm.ac.uk/sites/default/files/prone_position_in_adult_critical_care_2019.pdf
3.Gomaa D, et al. Respir Care 60(2):e41-e42, 2015.
4. Mitchell DA, et al. AACN Adv Crit Care 29(4):415-425, 2018.

AACN Procedural Manual-7th ed

- Chapter 18: Pronation Therapy
- Authors
  - Kathleen Vollman
  - Jan Powers
  - Sharon Dickinson

Updated Addition Coming Soon





Rotoprone

Prone positioner
No longer sold

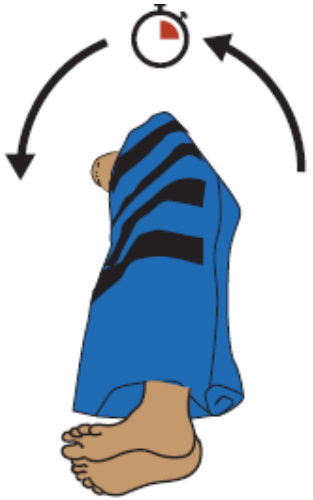
Manual Proning

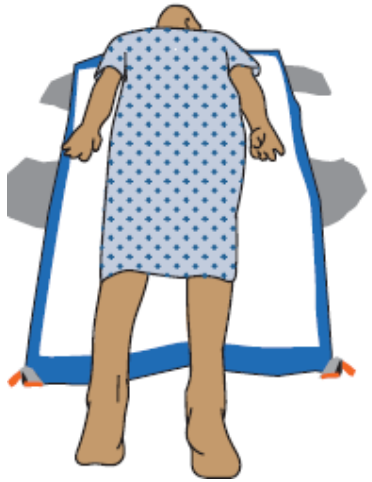
Mayo© 2017

Mayo© 2017

Prone Positioning with Positioning Sheet Using the Burrito Method

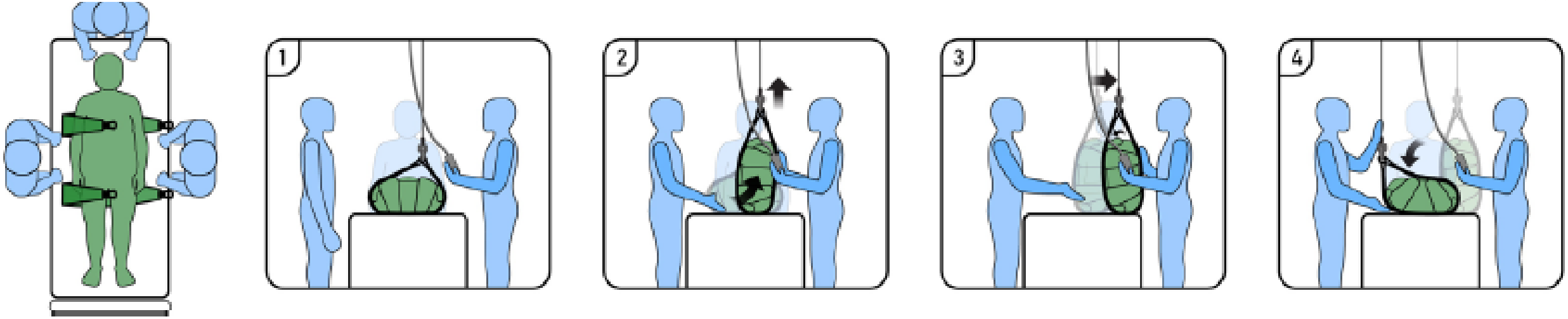
Disposable Slide Sheets





Chest and/or pelvic support can be done by placing a pillow/wedge before completing the turn.

Lift Assisted Prone Positioning



Wiggermann N, et al. Human Factors 2020 Nov;62(7):1069-1076.

Positioning Schedule & Maintenance Care[1,2]

Consider every 16hrs uninterrupted (more frequent turn back may cause decruitment)

Obtain post prone measurements

Restart feeding

Assess for pain & agitation minimum of q4

Q 2hr limb and head reposition (Swimmers), support feet in correct anatomical alignment

If hemodynamic monitoring, level the zero-reference point at the right atrium

Consider time periods in reverse Trendelenburg to address facial edema and reduce risk of vomiting

Frequent oral hygiene and suctioning and eye care as needed

1. Vollman KM, Dickenson S, Powers J. AACN Procedural Manual, Chapter 19;2016:142-163
2. Mitchell DA, et al. AACN Advanced Critical Care, 2018;29(4):415-425

Maintenance Care–Additional Things to Consider

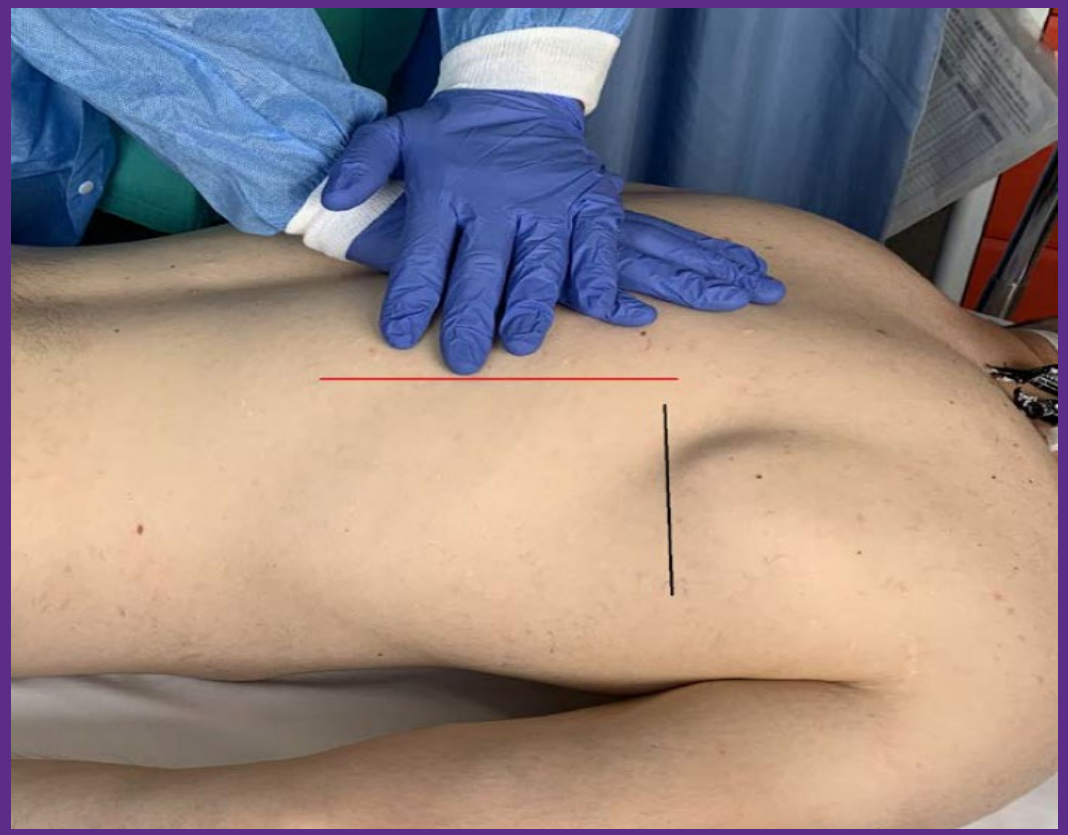
- Consider floating the nasogastric tube to prevent pressure injuries
- Consider pillows, use of liter bags of IV fluids or fluidizer positioner to align the head and neck
- Use silicone preventive dressing under ECMO cannulas

Image courtesy of Sharon Dickinson

Image courtesy of Sharon Dickinson

CPR In the Prone Position

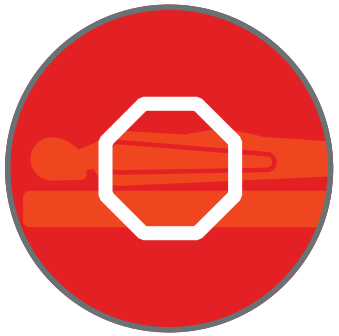
- AHA guidance
  - If patient has advanced airway consider initiating prone CPR until team can safely turn supine
  - Hand placement T7-T10
  - If unable to transition patient o supine & defib is required
    - Pads in anterior and posterior position



Anez C, et. al *Anesth Analg*. 2021;132(2):285-292.

Atkins et al.; 2022 Guidance for BLS/ACLS in COVID-19 Patients

When to Stop Prone Positioning?



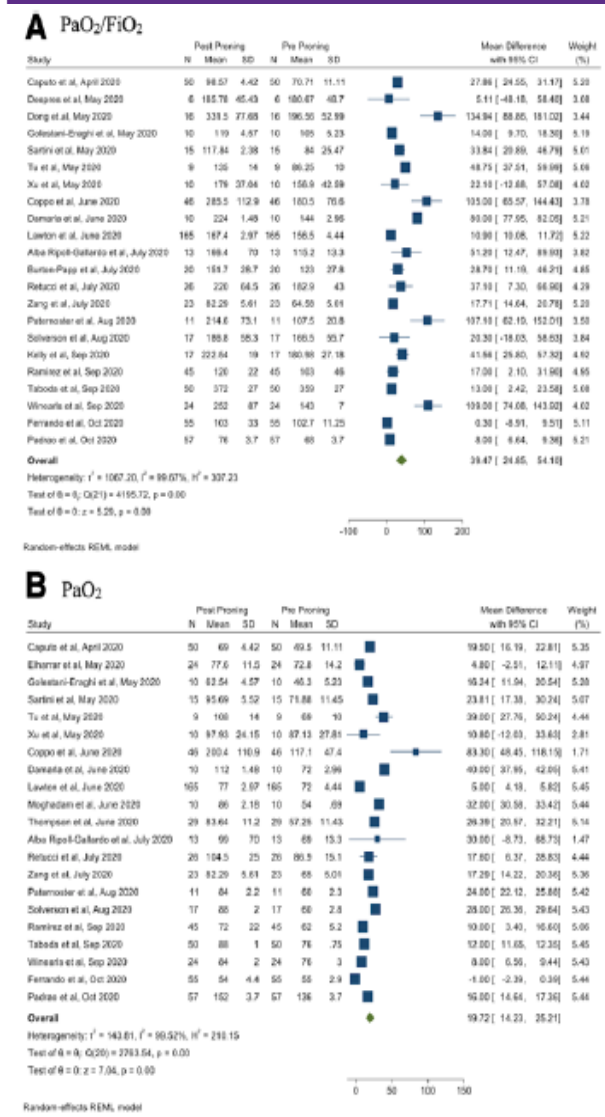
Research supports stopping prone positioning when PaO_2/FiO_2 has remained >150 mmHg 4 hours after supinating (with PEEP <10 cm H_2O and FiO_2 <0.6)

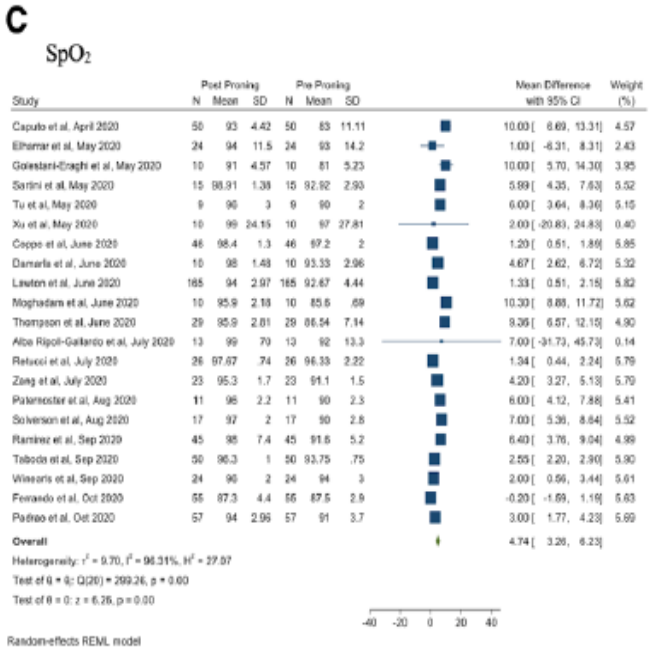
If there is no response after 48 hours, question whether prone positioning should continue

Scholten EL, et al. *Chest*. 2017;151(1):215-224.

Does Awake Proning Impact Patient Outcomes? Systematic Review and Meta-Analysis

- Studies reporting prone position in hypoxemic, non-intubated adults with COVID 19
- 25 observational studies, 758 patients
- Median dose 120 min, 1 to 3x per day
- 40% in ICU, 60% outside ICU
- Examine impact on p/f ratio, PaO2, SpO2, intubation rate & mortality
- Significant heterogeneity in location, dose & frequency & respiratory support

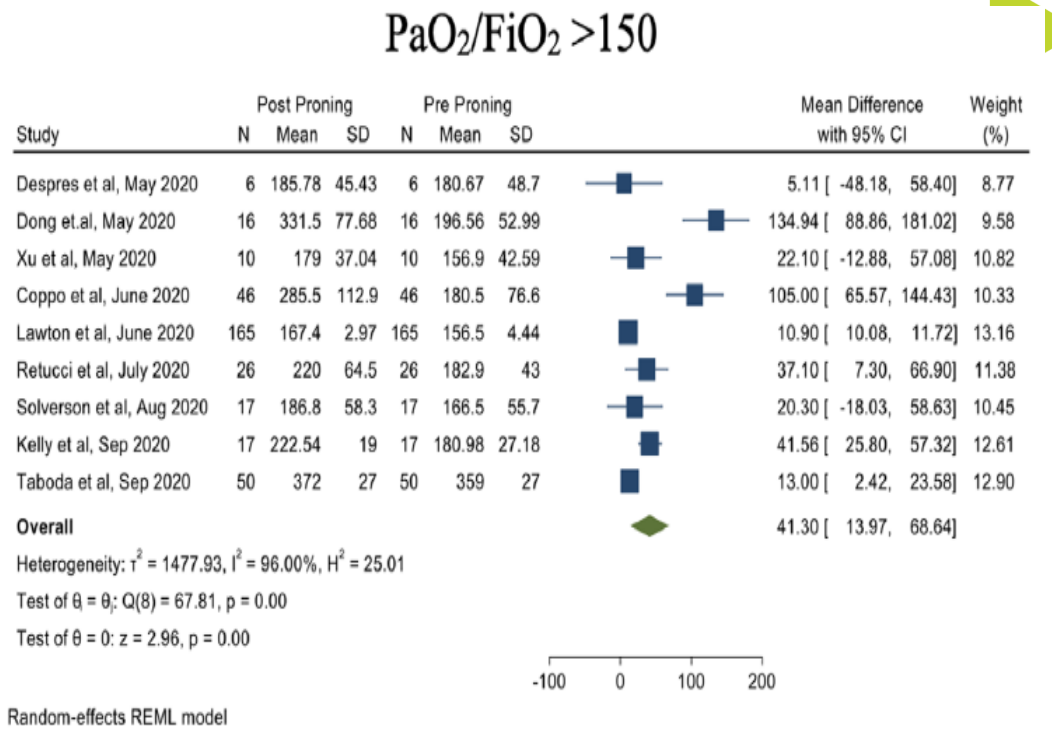


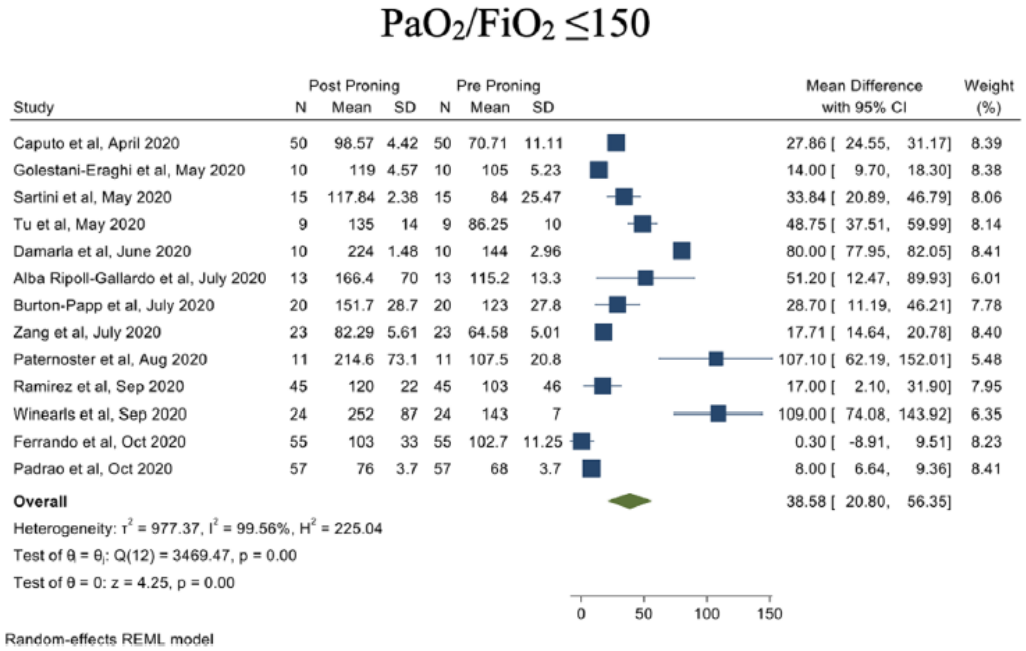


Reddy MP, et al Crit Care Med, 2021; 49(10): e1001-e1014

Does Awake Proning Impact Patient Outcomes? Systematic Review and Meta-Analysis

- Results
  - Improvement in P/F ratio 20mmHg, and RR ↓ 3.2 breaths per minute
  - Intubation rate 24%, mortality 13%
  - No life threatening or major adverse events
  - Minor: pain in the back, sternum & scrotum, general discomfort, dyspnea & coughing





Reddy MP, et al Crit Care Med, 2021; 49(10): e1001-e1014

Awake Prone Positioning with COVID: Open Label RCT

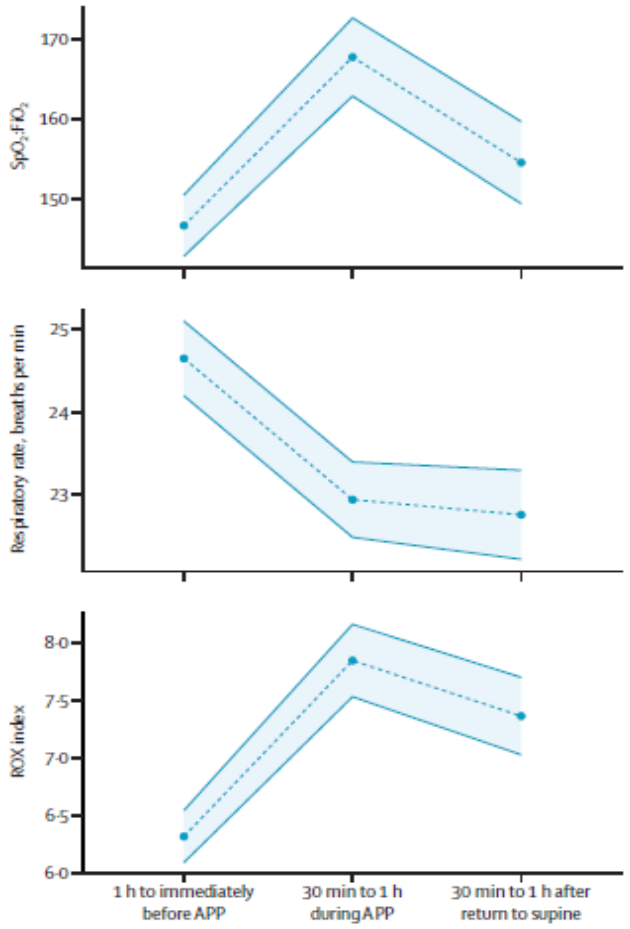
- Efficacy of awake proning to prevent intubation or death
- International open label RCT
- COVID 19 hypoxemic respiratory failure defined as: requiring respiratory support with HFNC & P/F ratio of $\leq$ 315 randomized to awake prone positioning or standard care
  - Awake prone (567)
  - Standard care (559)
- Patient instructed to lie in PP as frequent and as long as can be tolerated each day
- Awake proning cease when weaning HFNC because of improve oxygenation
- Pre-defined criteria for intubation was used in both group
- Outcomes:
  - Tx failure define as intubation or dying within 28 days of enrolment
  - Secondary outcome: intubation, mortality, use of non-invasive vent, time to intubation, time to death, Hospital LOS

6 Countries: Mexico, US, Spain, Canada, France & Ireland

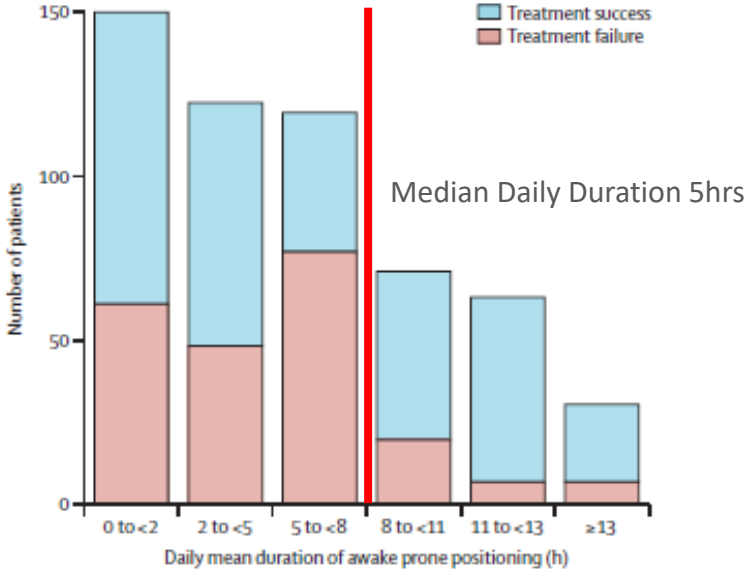
Ehrmann S, et al. *Lancet Respir Med*. 2021;9(12):1387-1395.

Awake Prone Positioning with COVID: Open Label RCT

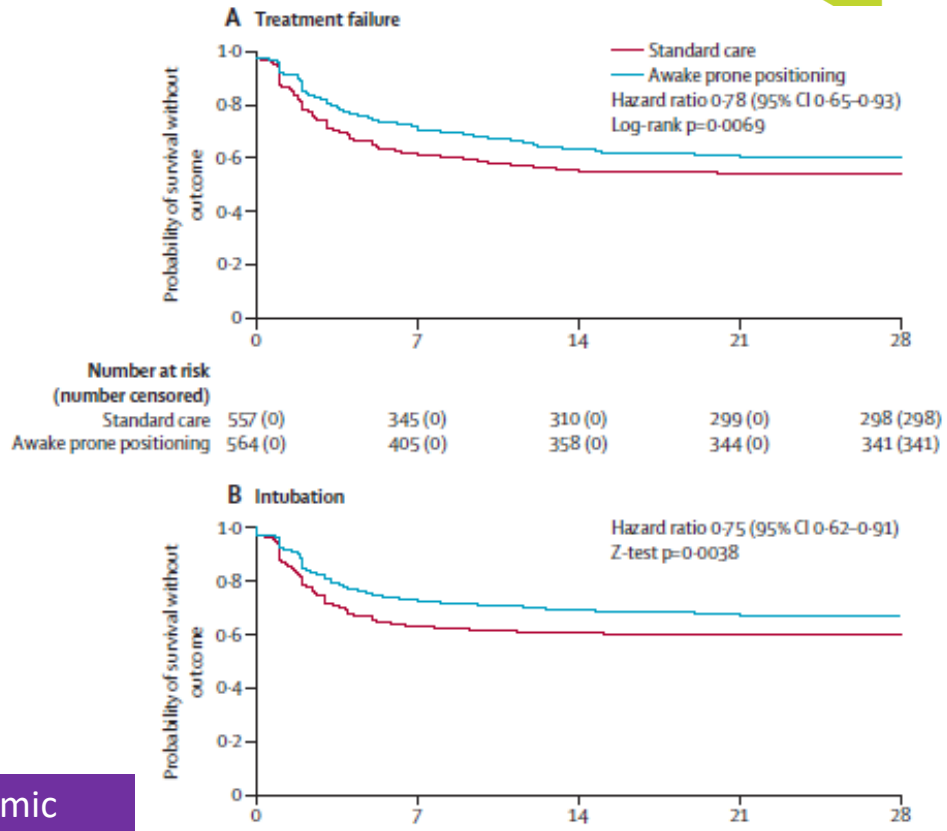
Physiologic Impact of Awake Prone Positioning



Time Spent in Prone Position



Outcomes

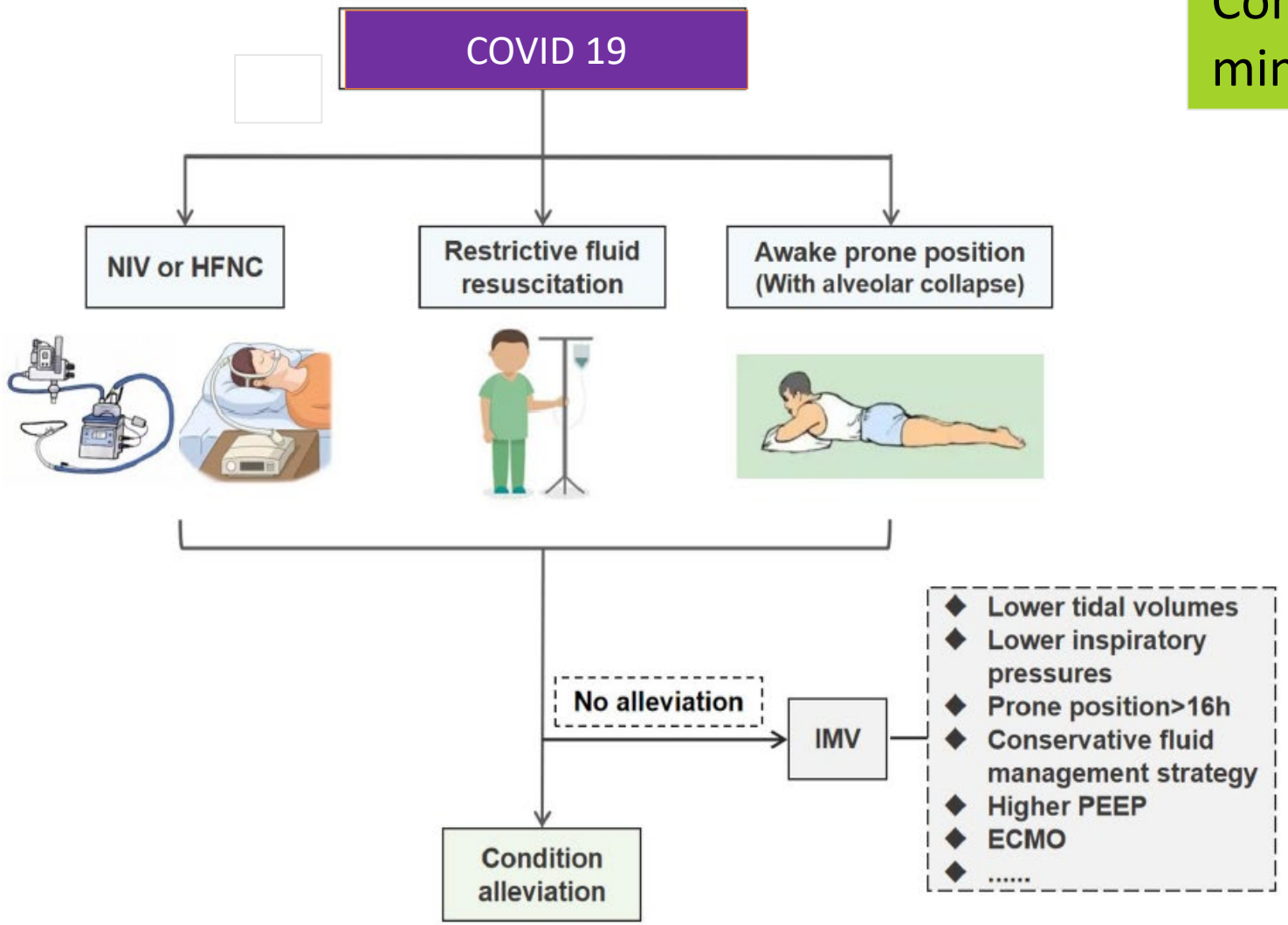


Awake prone position of patients with hypoxemic respiratory failure from COVID 19 reduces the incidence of treatment failure and need for intubation without any signal of harm - NNT 14

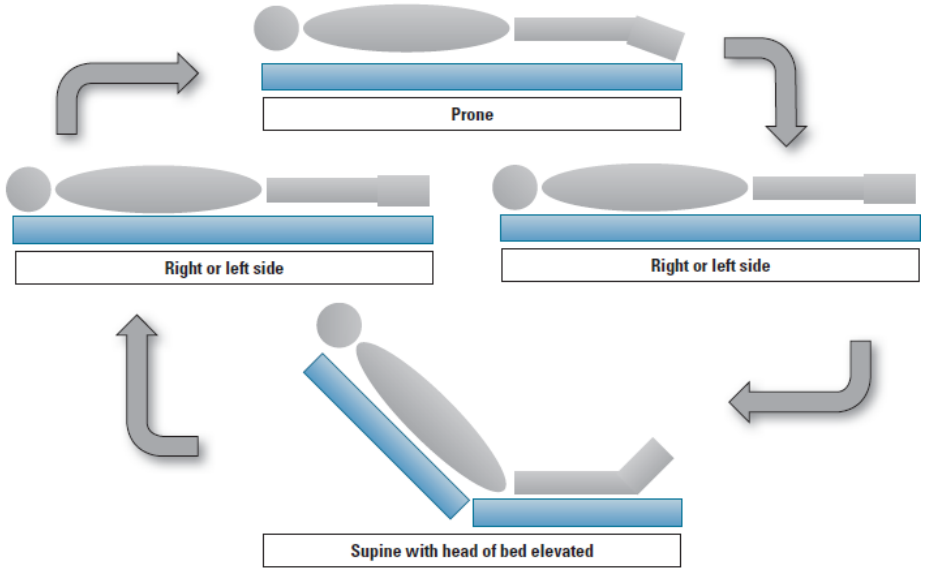
Ehrmann S, et al. *Lancet Respir Med*. 2021;9(12):1387-1395.

Prone Positioning for COIVD Awake Patients

Consider prone positioning 30 min up to 4hrs. 2 to 4x daily



Sun Q, etal Annals of Intensive Care, 2020:10:33



Seckel MA.. Crit Care Nurse. 2021;41(4):76-79

ESICM ARDS 2023 Guidelines Update

- We **suggest** awake prone positioning as compared to supine positioning for non-intubated patients with COVID-19-related AHRF to reduce intubation.
  - Weak recommendation; low level of evidence in favor.
- We are **unable to make a recommendation** for or against APP for non-intubated patients with COVID-19-related AHRF to reduce mortality.
  - No recommendation; moderate level of evidence of no effect.
- We are **unable to make a recommendation** for or against APP for patients with AHRF not due to COVID-19.
  - No recommendation; no evidence.

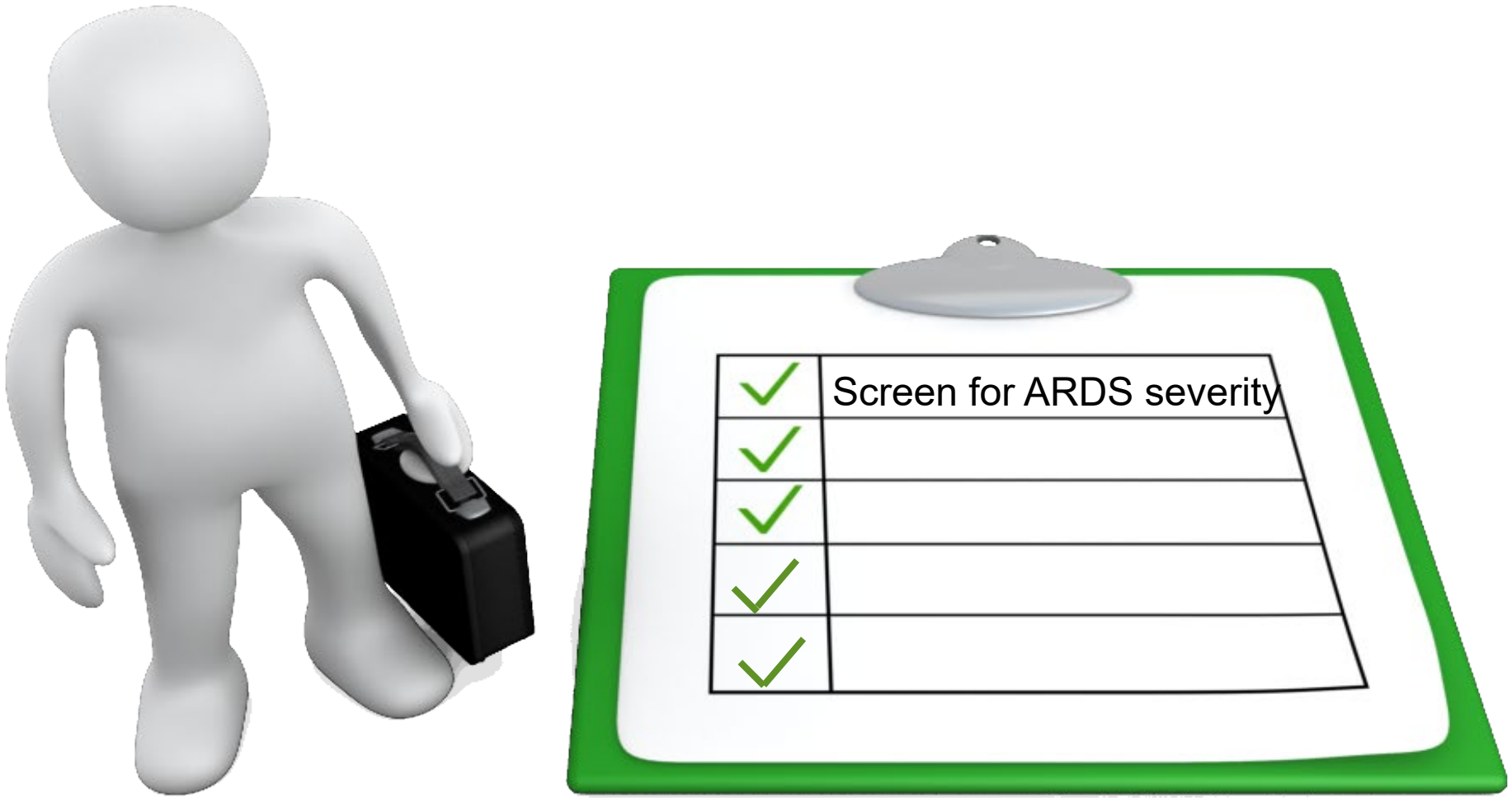
Grasselli, G., et al. Intensive Care Med 49, 727–759 (2023).


What are the
Challenges & Issues

Adverse Events	No. of Trials Reporting the Outcome	Events/Prone	Events/Supine	Treatment Effect (Random-Effect Model) OR (95% CI)	p	Number Needed to Treat/Number Needed to Harm	Heterogeneity I² (%)	p
Ventilator-associated pneumonia	6	120/567	128/513	0.76 (0.44–1.33)	0.343	26	34.4	0.192
Pressure ulcers	6	294/698	218/646	1.49 (1.18–1.89)	0.001	12	0.0	0.617
Major airway problem[a]	9	255/1,104	180/1,063	1.55 (1.10–2.17)	0.012	16	32.7	0.167
Unplanned extubation	7	113/1,091	98/1,050	1.17 (0.80–1.73)	0.421	98	25.5	0.234
Selective intubation	2	12/642	5/615	2.73 (0.29–25.46)	0.378	95	55.9	0.132
Endotracheal tube obstruction	4	130/823	77/802	2.16 (1.53–3.05)	<0.001	16	0.0	0.580
Loss of venous or arterial access	4	36/407	22/397	1.34 (0.29–6.26)	0.712	30	75.5	0.007
Thoracostomy tube dislodgement or kinking	4	14/407	14/397	1.14 (0.35–3.75)	0.827	1,154	42.6	0.175
Pneumothorax	4	29/513	33/462	0.77 (0.46–1.30)	0.333	67	0.0	0.528
Cardiac arrest	3	104/718	119/675	0.74 (0.47–1.17)	0.197	32	30.3	0.238
Tachyarrhythmia or bradyarrhythmia	3	115/663	102/634	1.08 (0.78–1.50)	0.643	80	8.8	0.334

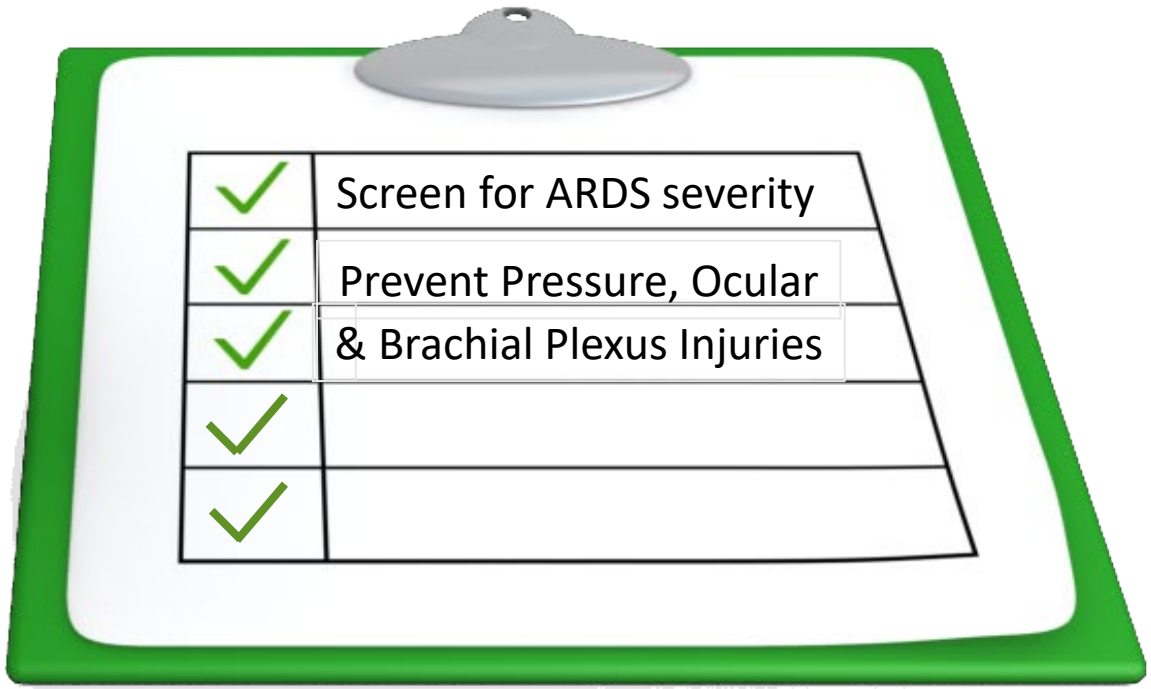
11.9% complication rate

Lee JM, et al. Crit Care Med, 2014;42(5):1252-1262


Screen for ARDS severity

Does your ICU have a process for assessing P/F ratios routinely?

	Mild	Moderate	Severe
Oxygenation	< 200 PaO_2/FiO_2 or ≤ 300 with PEEP/ CPAP ≥ 5 cm H_2O	< 100 PaO_2/FiO_2 or ≤ 200 with PEEP ≥ 5 cm H_2O	≤ 100 PaO_2/FiO_2 with PEEP ≥ 5 cm H_2O


Screen for ARDS severity
Prevent Pressure, Ocular
& Brachial Plexus Injuries

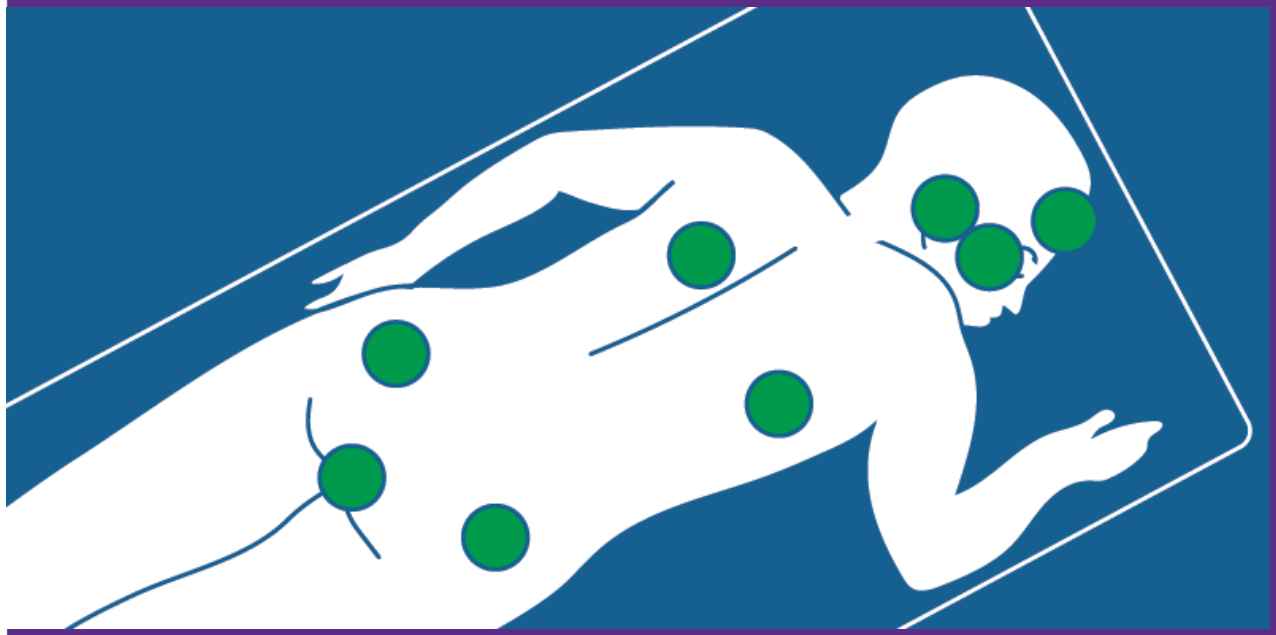
Pressure Injury Risk in the Prone Patient[1,2]

- Incidence[1,2]
  - Prone position for ARDS increased odds of pressure injury
    - Ranges 1.22- 1.37 (95% CI 1.05 to 1.79)
    - PI 37% more common in prone pts

1.Bloomfield R, et al. Cochrane Database Sys Rev, 2015, 11 CD08095.
2. Munshi L, et al. Ann Am Thorac Soc, 2017, 14 S4, S280-S288.

Pressure Injury Prevention: Prone Positioning

- Redistribution surface
- Positioning devices to offload pressure points (Do not use ring or donut-shaped positioning devices)
- Avoid shear and friction during the turning process
- Small micro turns while prone/swimmer position shifts q 2-4 hrs
- Assess skin with when doing small positioning shifts
- Placement of prophylactic dressings over all potential pressure injury risk areas



Green areas represent pressure sources while lying prone

https://cdn.ymaws.com/npiap.com/resource/resmgr/online_store/posters/npiap_pip_tips_-_proning_202.pdf NPIAP 2020

Head Specific Interventions to Reduce PI while Proning

- Apply soft silicone multilayered foam prophylactic dressings to pressure points on the face (cheeks, forehead, chin and consider strips around the corners of the mouth)[1]
- Turn the head q 2 hrs[1]
- Manage moisture /oral & nasal secretions[1,2]
  - Liquid skin protected or sealants on the face
  - Change form dressings PRN
  - Consider applying hydro fiber or calcium alginate dressings under prophylactic dressings to manage excess moisture (chin, mouth area and cheeks)
- Consider removing commercial ETT holder and use tape or twill. Places patients at risk for pressure injuries[1,2]
- Apply thin foam dressings under medical devices—including ETT securement (tape-twill)[1,2]

Jackson ME, et al. Respir Care. 2012;57(2):311-314
Kim RS, et al. J Wound Ostomy Continence Nurs. 2016;43(4):427-429

Smart H. *Adv Skin Wound Care*.2021;34(7):390-391.

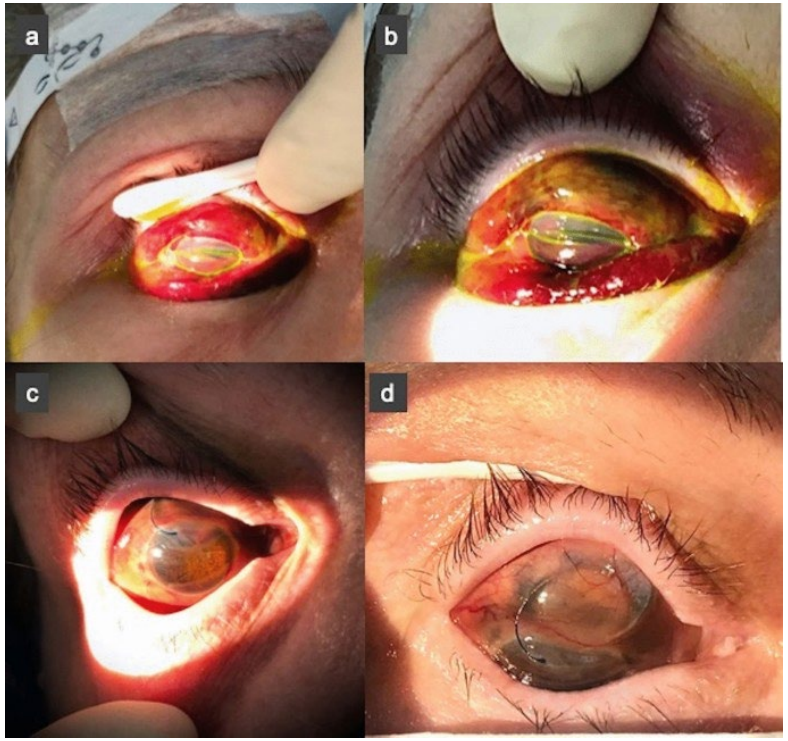
1. https://cdn.ymaws.com/npiap.com/resource/resmgr/online_store/posters/npiap_pip_tips_-_proning_202.pdf NPIAP 2020

2. Peko L, et al. *Int Wound J*. 2020;17(6):1595-1606. doi:10.1111/iwj.13435

Ocular Injury

- Meta-analysis of prone positioning studies examining ocular injury occurrences, they found only a 1.3% incidence in prone patients while 1.9% in supine patients[1]
- Corneas at most risk: [2]
  - Blinking issues
  - Reduction in tear production
  - Failure of eye closure

Global Eye Rupture from Prolonged Prone Positioning



Leuzinger-Dias, M et al. *Ophthalmol Ther* **10,** 691–697 (2021)

1.Patterson TJ, at al. Am J Ophthalmol. 2021 Mar 3:S0002-9394

2. Sansome SG, et al. British Journal of Hospital Medicine. 2020;81(6):1-10.

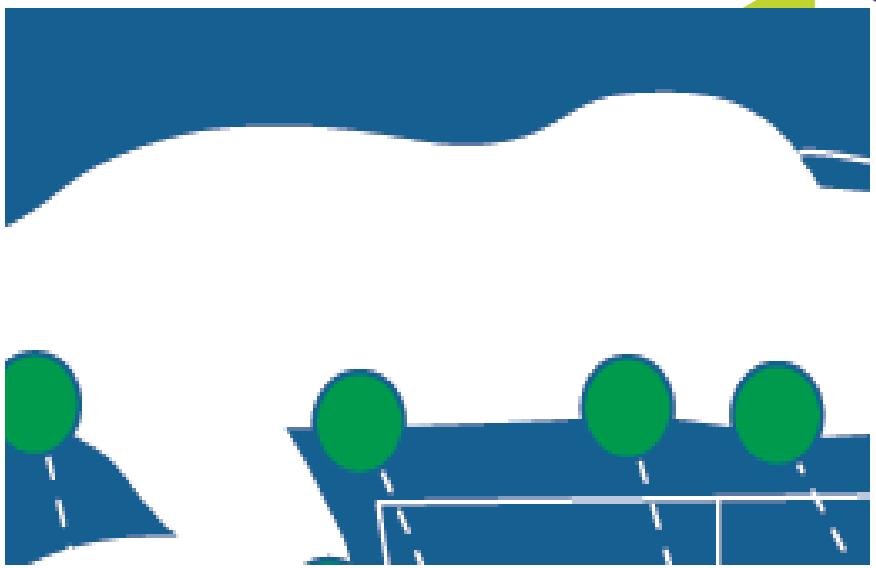
Evidence –Based Strategies to Reduce Injury[1,2]

- Perform eye assessment daily and prior to proning.
- Clean the eyes with saline soaked gauze, apply ointment then horizontally tape the eye lids closed.
- In the presence of conjunctival or corneal exposure increase the frequency of eye ointment application as per institutional policy.
- Use of reverse Trendelenburg to reduce eye conjunctival edema

1. Sansome SG, et al. British Journal of Hospital Medicine. 2020;81(6):
2. Sanghi P. et al., J Intensive Care Med. 2021 Mar;36(3):361-372.

Torso

- EKG leads on the back while prone
- Apply prophylactic dressing to pressure points and high shear areas
- Secure all tubes and devices away from the skin
  - protect surrounding skin with prophylactic dressings & bridged areas with positioning devices
  - Create channels for tubes with positioning aids
- Breast & genitalia
  - Should be offloaded and protected



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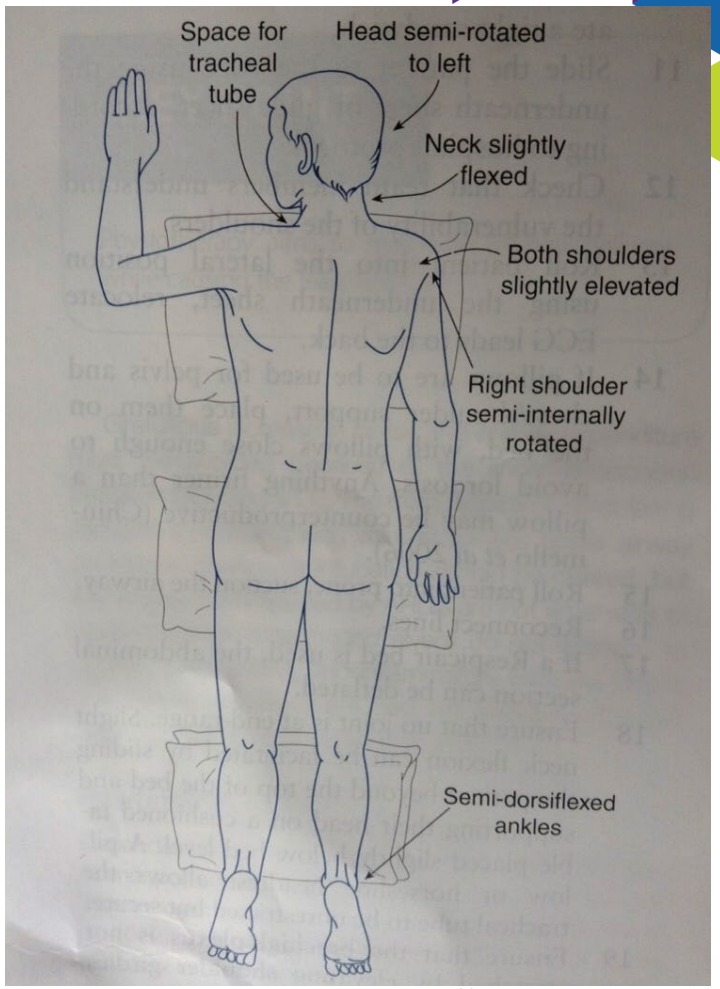
Brachial Plexus & Ulnar Safety

- Maintain straight spine alignment & avoid excessive arm rotation[1-3]
- Avoid positions of extension of the shoulders and support the chest well to ensure shoulder is forward flexed or falling forward[1,3]
- Avoid positioning arm in abduction beyond 70 degrees with elbow extension and external rotation of the shoulder beyond 60 degrees[3]
- Avoid hyperextension of the neck by adjusting height of head chest and pelvic supports[2,3]

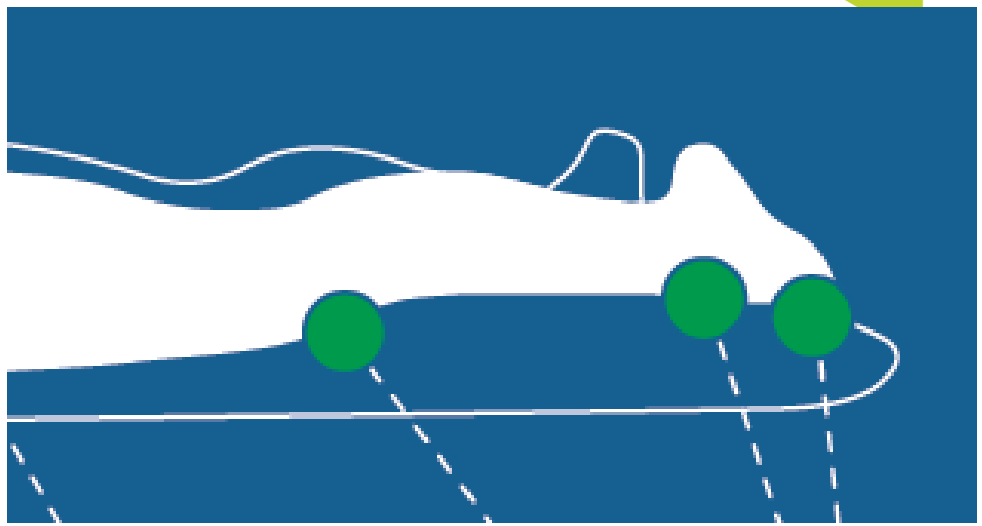


https://www.physio-pedia.com/Acute_Respiratory_Distress_Syndrome_%28ARDS%29 Physiopedia.com

1. Bamford P, et al. Available from https://www.ficm.ac.uk/sites/default/files/prone_position_in_adult_critical_care_2019.pdf.
2. Simpson AI, et al. J Intensive Care Med. 2020;35(12):1576-1582
3. Miller C, et al. *Phys Ther*. 2021 Jan 4;101(1)

Legs & Feet

- Apply Prophylactic foam dressings to the Patella and pretibial area
- Remove securement devices and align urinary catheter & fecal management devices towards the foot of the bed
- Ensure there are no unsecured devices under the legs
- Offload the feet



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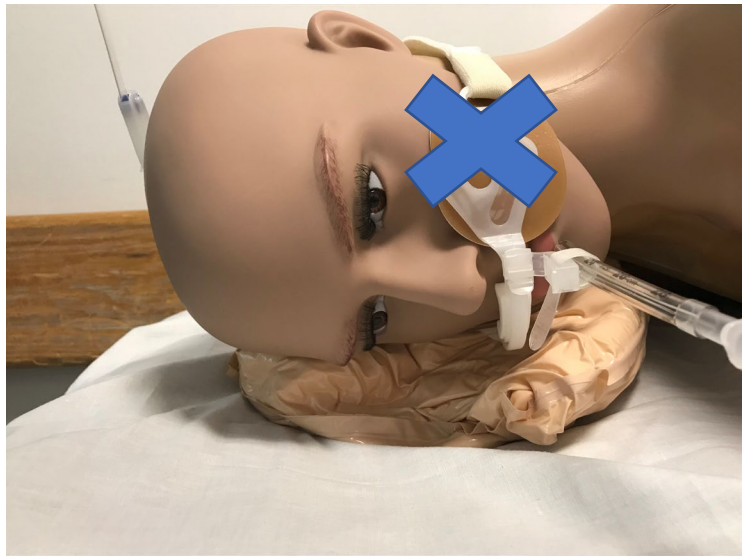
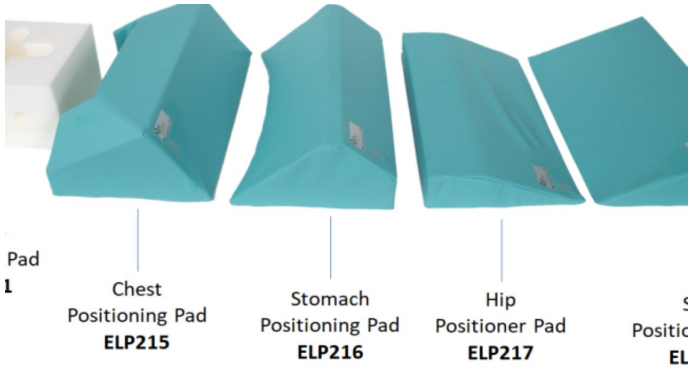
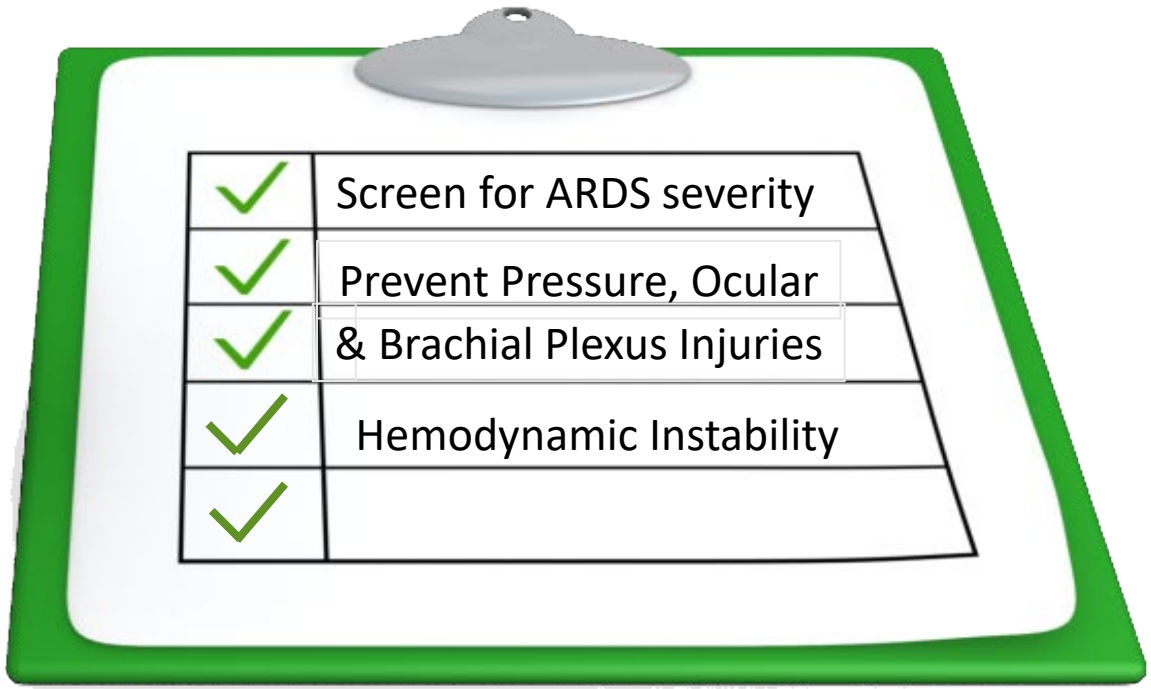




List various equipment available for prone (Fourie A, et al. *J Tissue Viability*. 2021;30(4):466-477.


Screen for ARDS severity
Prevent Pressure, Ocular
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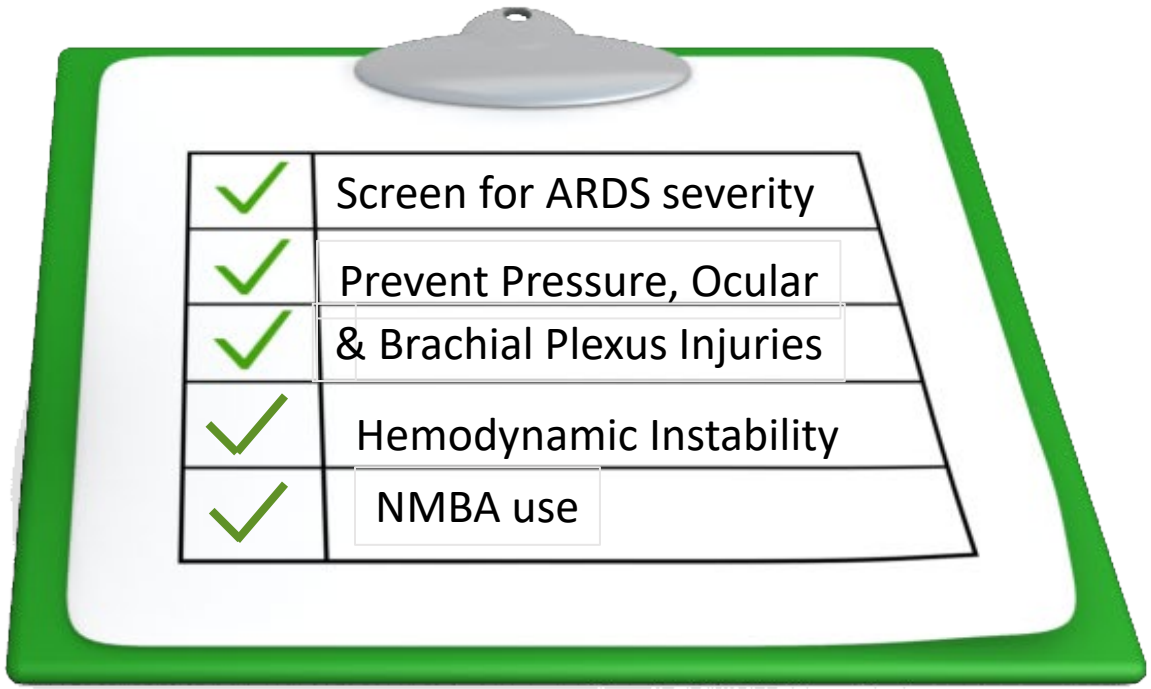
Hemodynamic Instability

The Role of Hemodynamic Instability in Positioning[1]

- Lateral turn results in a 3%-9% decrease in SVO_2, which takes 5-10 minutes to return to baseline
- Appears the act of turning has the greatest impact on any instability seen
- Minimize factors that contribute to imbalances in oxygen supply and demand
- Factors that put patients at risk for intolerance to positioning:
  - Elderly
  - Diabetes with neuropathy
  - Prolonged bed rest
  - Low hemoglobin and cardiovascular reserve
  - Prolonged gravitational equilibrium

Right ventricular function improves in PP/ ↑ preload & CI[2]

1.Vollman KM. Crit Care Nurs Q. 2013;36:17-27
2. Zochios V, et al. J of Cardio & Vascular Anesth, 2018;32:2248-2251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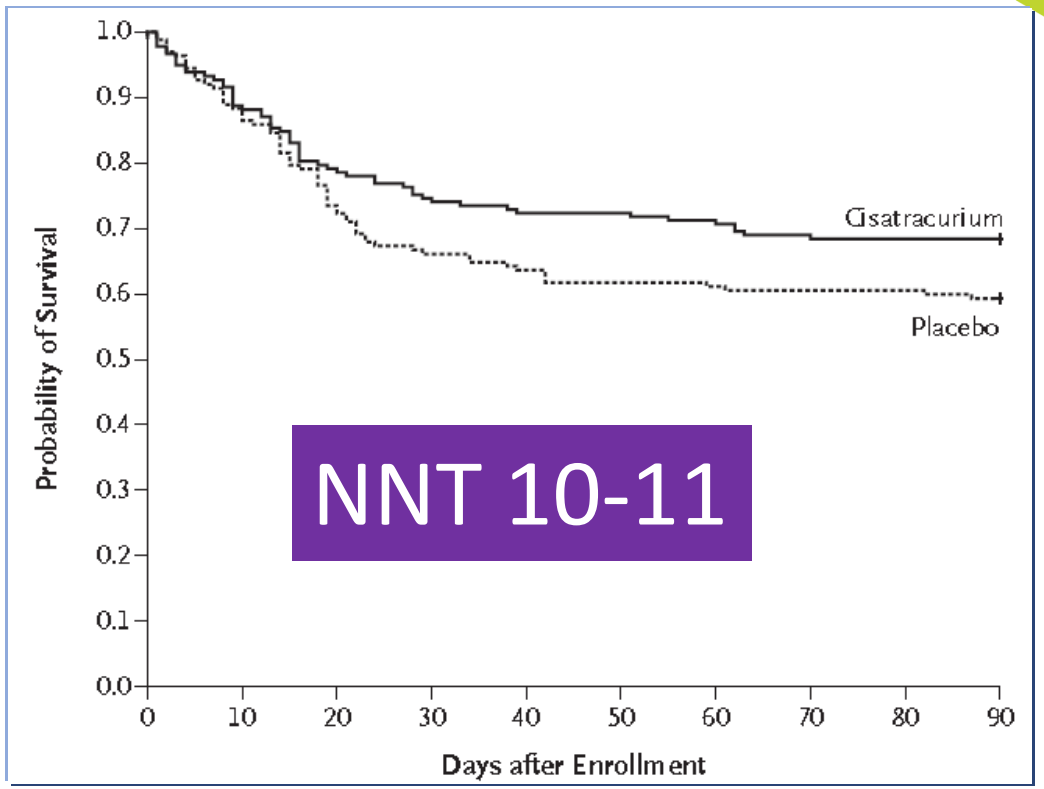
Hemodynamic Instability
NMBA use

Neuromuscular Blockade in Early ARDS

- Multicenter, double blind trial
- 340 patients with ARDS within 48hrs of admitted to ICU
- ARDS defined as P/F ratio of < 150 ≥ PEEP 5cm & Vt of 6-8 ml/kg PBW
- Randomized to receive 48hrs of cisatracurium or placebo
- Study did not use train of 4

Results:

- After risk adjustment NMB group showed improved mortality at 90 days (31.6% vs. 40.7%)
- Also significant at 28 days
- ↑time off vent
- No difference in muscle weakness



Papazian L, et al. N Engl J Med. 2010;363(12):1107-16

ROSE Trial: Re-evaluation of Systemic Early Neuromuscular Blockade

- Protocol: moderate to severe ARDS < 48hrs / P/F ratio < 150 with ≥ PEEP 8 cm
- Cisatracurium for 48hr or usual care
- Protocol changed mid-study, removed RM

The ROSE trial at 90-day follow-up in patients with moderate-to-severe ARDS, 42.5% of the intervention group and 42.8% of the control group died before hospital discharge (between group difference -0.3%, 95% CI -6.4 to 5, *P*=0.93), -study stopped early.

Petal Network. N Engl J Med. 2019 May 23;380(21):1997-2008.

Prone Positioning used 15.8%. Equal use in both groups

ESICM ARDS 2023 Guidelines Update

- We **recommend against** the *routine* use of continuous infusions of NMBA to reduce mortality in patients with moderate-to-severe ARDS not due to COVID-19.
  - Strong recommendation, moderate level of evidence.
- We are **unable to make a recommendation** for or against the *routine* use of continuous infusions of NMBA to reduce mortality in patients with moderate-to-severe ARDS due to COVID-19.
  - No recommendation; no evidence.

Questions That Remain

- What is optimal PEEP management in the prone position?
- Does effective prone positioning necessitate neuromuscular blockades for several days?
  - And, what impact does that have on ICU-acquired weakness?
- How do we incorporate what we learned about the impact of prone positioning during the COVID 19 pandemic into our practice?
- What is the role of awake non-intubated proning post COVID 19?

Scholten EL, et al. *Chest.* 2017;151(1):215-224.

Summary

- Use the prone positioning
- Implement early—don’t wait
- Develop a process or protocol to minimize complication risk
- Training all providers to mastery is critical


Jay '91
"HAPPY TURNING"

Kathleen Vollman
ADVANCING NURSING THROUGH KNOWLEDGE & INNOVATION

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