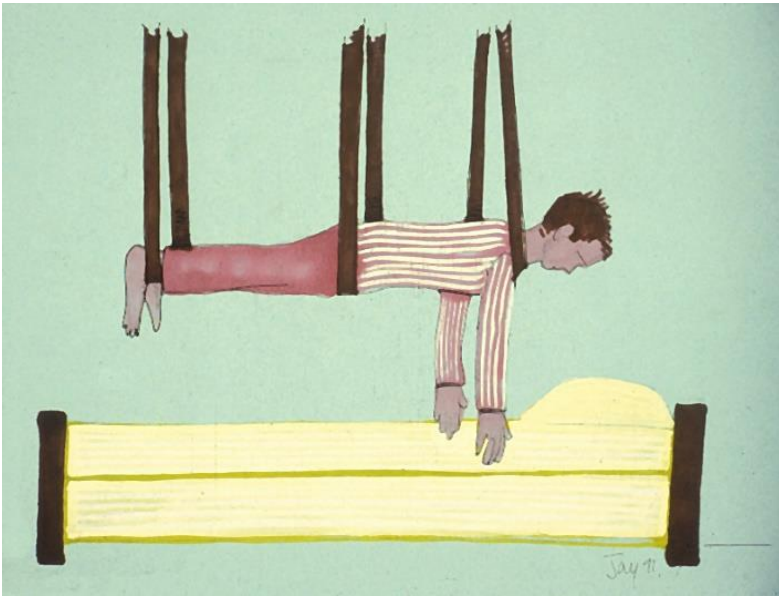


# Best Practices in Proning



28843



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ADVANCING NURSING THROUGH KNOWLEDGE & INNOVATION



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  - Atlas Lift Tech
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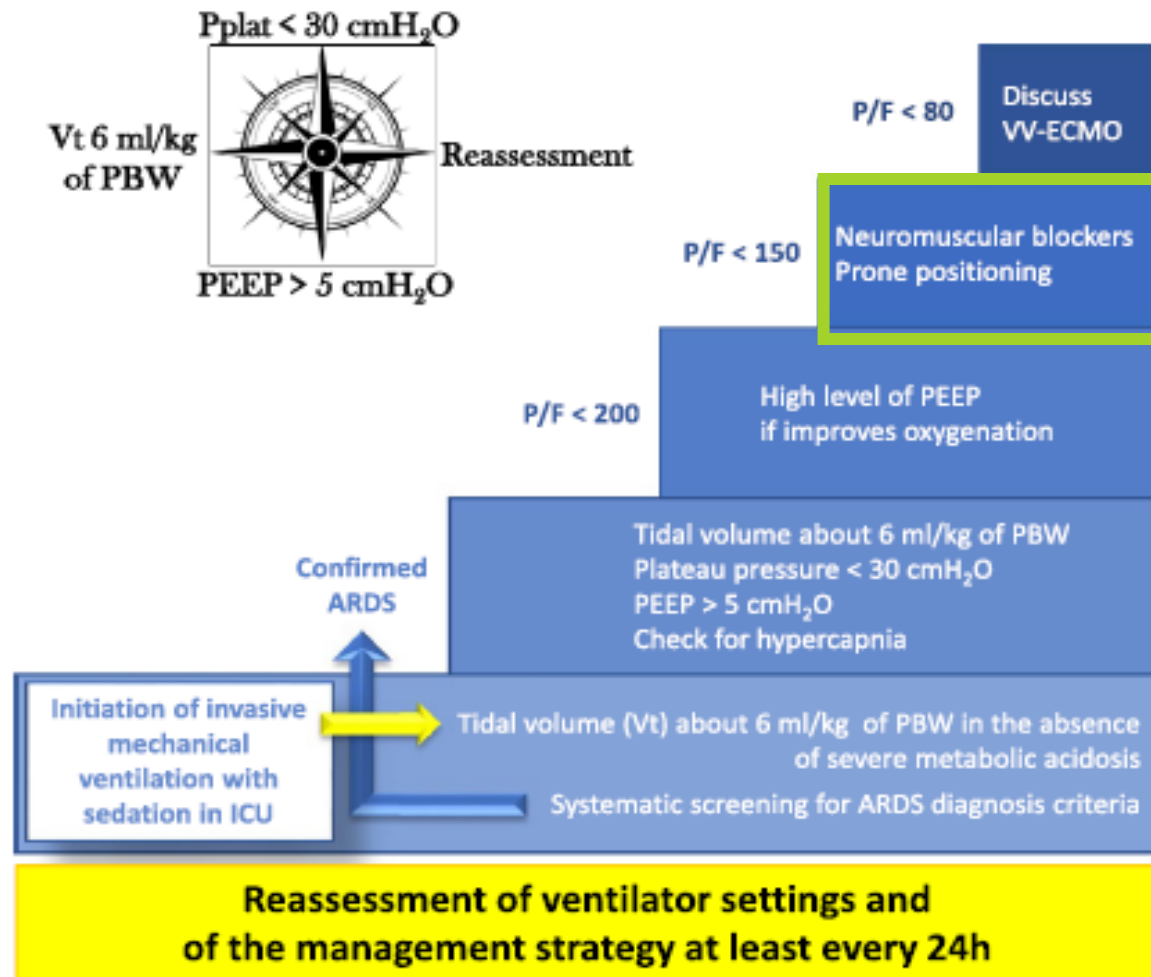
# Objectives

- 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

# The Berlin ARDS Definition

<b>TIMING</b>	Within 1 week of a known clinical insult or new/worsening respiratory symptoms		
<b>CHEST IMAGING (X-RAY OR CAT SCAN)</b>	Bilateral opacities—not fully explained by effusions, lobar/lung collapse, or nodules		
<b>ORIGIN OF EDEMA</b>	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		
	<b>MILD</b>	<b>MODERATE</b>	<b>SEVERE</b>
<b>OXYGENATION</b>	<200 PaO <sub>2</sub> /FiO <sub>2</sub> or ≤300 with PEEP/CPAP ≥5 cm H <sub>2</sub> O	<100 PaO <sub>2</sub> /FiO <sub>2</sub> or ≤200 with PEEP ≥5 cm H <sub>2</sub> O	≤100 PaO <sub>2</sub> /FiO <sub>2</sub> with PEEP ≥5 cm H <sub>2</sub> O
<b>MORTALITY</b>	27% (24% to 30%)	32% (29% to 34%)	45% (42% to 48%)

# Early management of ARDS in 2019



ARDS severity

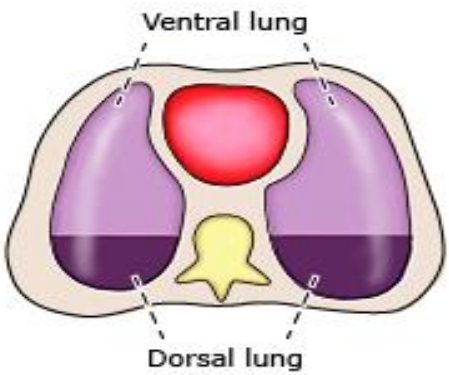
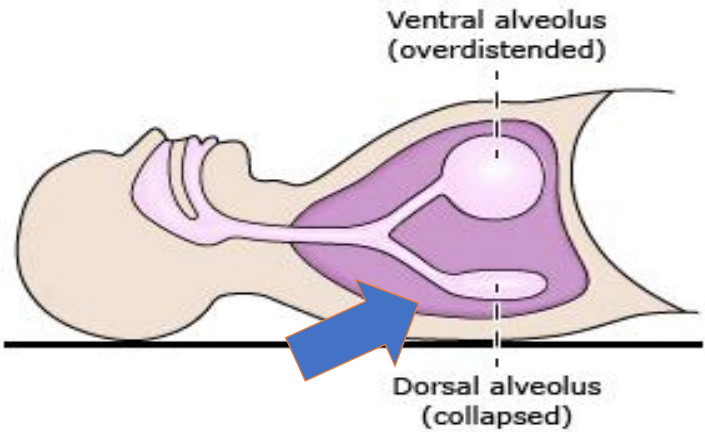

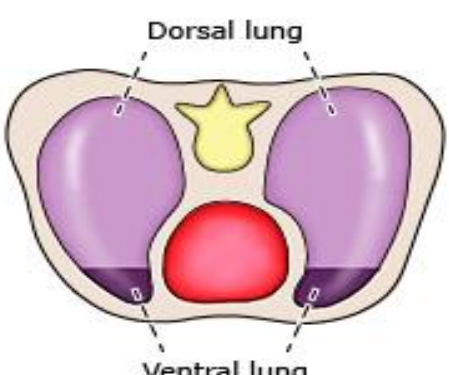
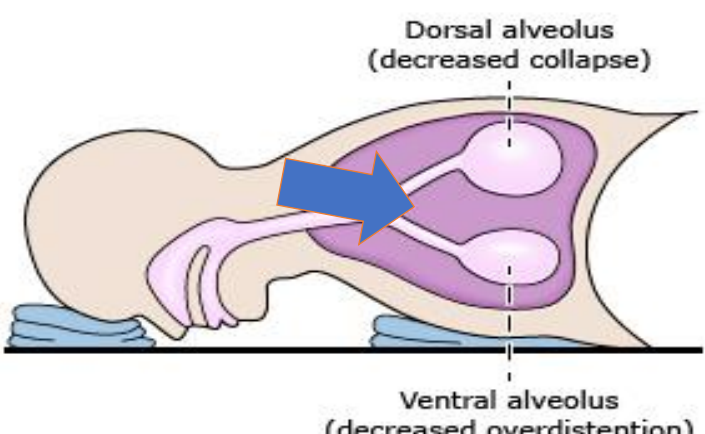

<b>Veno-venous ECMO</b> <input type="checkbox"/> In case of refractory hypoxemia or when protective ventilation can not be applied <input type="checkbox"/> To be discussed with experienced ECMO centres
<b>Neuromuscular blockers: continuous intravenous infusion</b> <input type="checkbox"/> Early initiation (within the first 48h of ARDS diagnosis)
<b>Prone positioning methods :</b> <input type="checkbox"/> Applied for >16h a day, for several consecutive days
<b>Moderate or severe ARDS -&gt; High PEEP test (&gt; 12 cmH<sub>2</sub>O)</b> <b>Use high levels if:</b> <input type="checkbox"/> Oxygenation improvement <input type="checkbox"/> Without hemodynamic impairment or significant decrease in lung compliance <input type="checkbox"/> Maintain Pplat < 30 cmH <sub>2</sub> O, continuous monitoring
<b>ARDS diagnosis criteria</b> <input type="checkbox"/> PaO <sub>2</sub> /FIO <sub>2</sub> ≤ 300 mmHg <input type="checkbox"/> PEEP ≥ 5 cmH <sub>2</sub> O <input type="checkbox"/> Bilateral opacities on chest imaging <input type="checkbox"/> Not fully explained by cardiac failure or fluid overload <input type="checkbox"/> Within a week of a known clinical insult
<b>Might be applied</b> > Inhaled Nitric Oxide (iNO), when severe hypoxemia remains despite prone positioning and before considering VV-ECMO > Partial ventilation support after early phase to generate tidal volume about 6 ml/kg and less than 8 ml/kg
<b>No recommendation could be made</b> > ECCO <sub>2</sub> rt > Driving pressure > Partial ventilation support at the early phase
<b>Should probably not be done</b> > Systematic recruitment maneuvers
<b>Should not be done</b> > HFOV

# Why Prone Positioning?<sup>1-2</sup>

- 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)
- ↓ PACO<sub>2</sub> relates to net increase in recruitment / ↓ in dead space
- Drains secretions

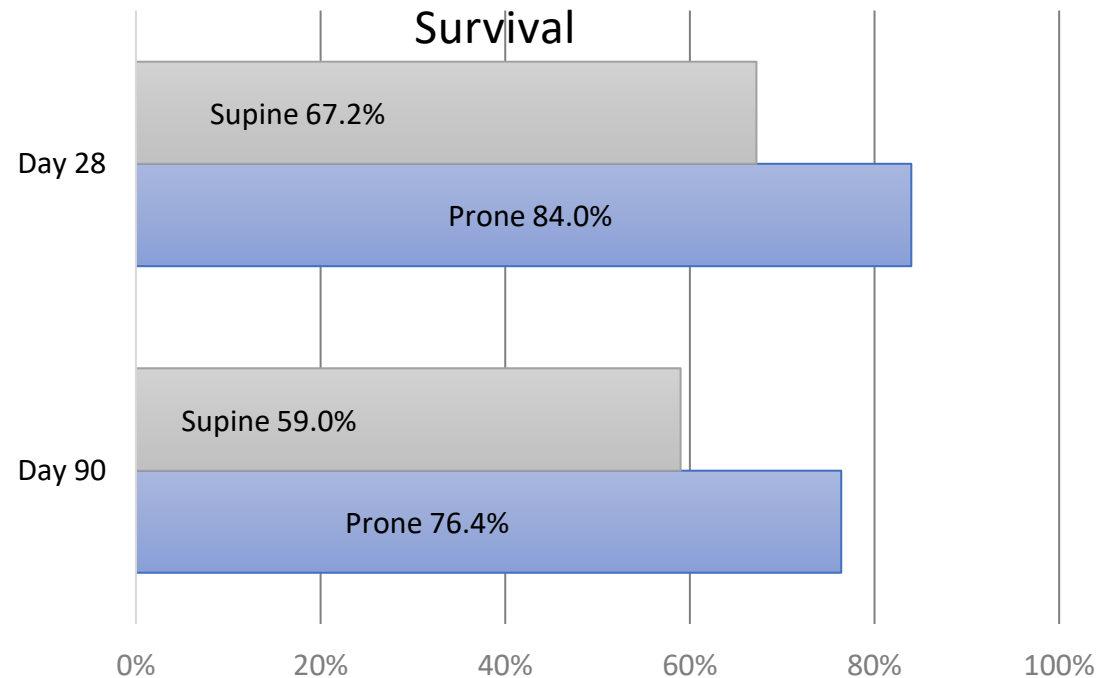
1. Scholten EL, et al. *Chest*. 2017;151(1):215-224

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

		PTP	Blood flow
<b>Supine position</b>			
 <p>Ventral lung</p> <p>Dorsal lung</p>	 <p>Ventral alveolus (overdistended)</p> <p>Dorsal alveolus (collapsed)</p>	<p>+++</p> <p>---</p>	<p>↓</p> 
<b>Prone position</b>			
 <p>Dorsal lung</p> <p>Ventral lung</p>	 <p>Dorsal alveolus (decreased collapse)</p> <p>Ventral alveolus (decreased overdistention)</p>	<p>+</p> <p>-</p>	<p>↑</p> 

Q&A

# Proning Severe ARDS Patients



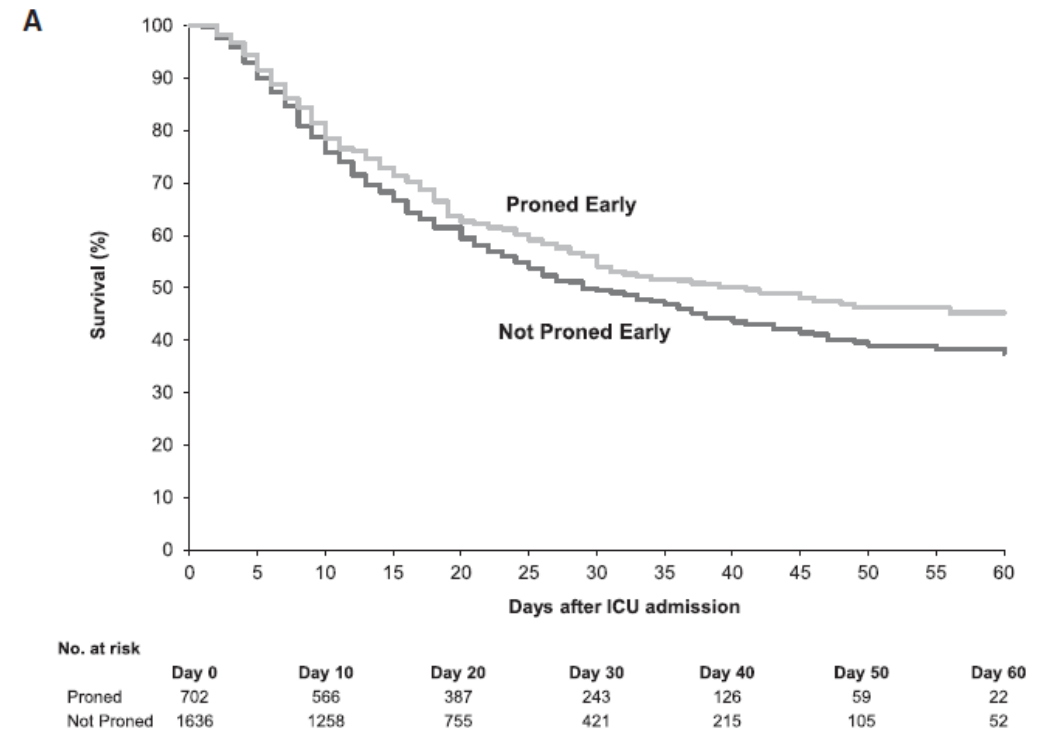
In a randomized, controlled trial of 466 patients with severe ARDS, survival was significantly higher at 28 and 90 days in the prone position group

**NNT=6**



# 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% prone
  - △ Lower in-hospital mortality if prone early
  - △ 19.5% prone later in the course of illness



# Who to Place in Prone Position?

- ▶ Patients with severe ARDS ( $\text{PaO}_2/\text{FiO}_2 < 150$  mmHg)
  - △ Per ATS/SCCM Mechanical Ventilation for ARDS guidelines, a strong recommendation for prone positioning for >12 hours /day
- ▶ Patients early in the course (12–24 hours)

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

Bein T, et al. Intensive Care Med. 2016;42:699-711). Fan E, et al. Am J Respir Crit Care Med. 2017;195(9):1253-1263

# Who Not to Place in Prone Position?

## Absolute Contraindications



---

**1**

Patients with  
facial/neck trauma  
or spine instability

**2**

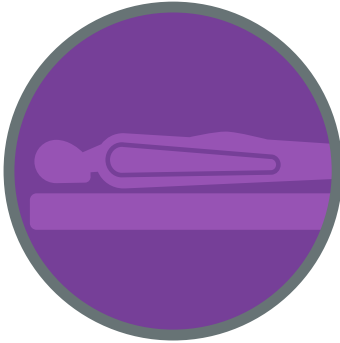
Goals of Care: Allow  
for a natural death  
(comfort care)

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# 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

# 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

Patients with pelvic fractures **4**

Patients with external fixators **5**

Patients with multiple traumatic injuries **6**

**7** Patients with use of extracorporeal membrane oxygenation (ECMO)

**8** Patients with continuous renal replacement therapy (CRRT)

Patients with morbid obesity

# Pre-Prone Position Process<sup>1-4</sup>

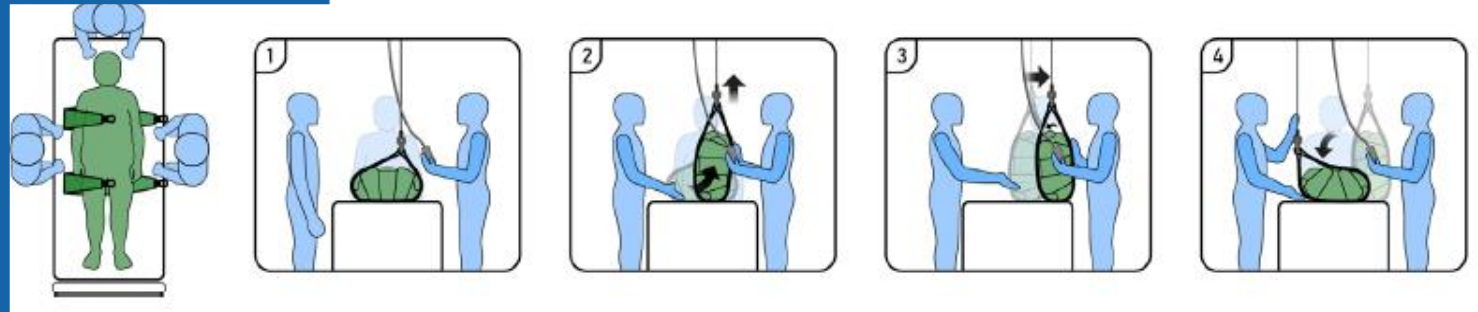
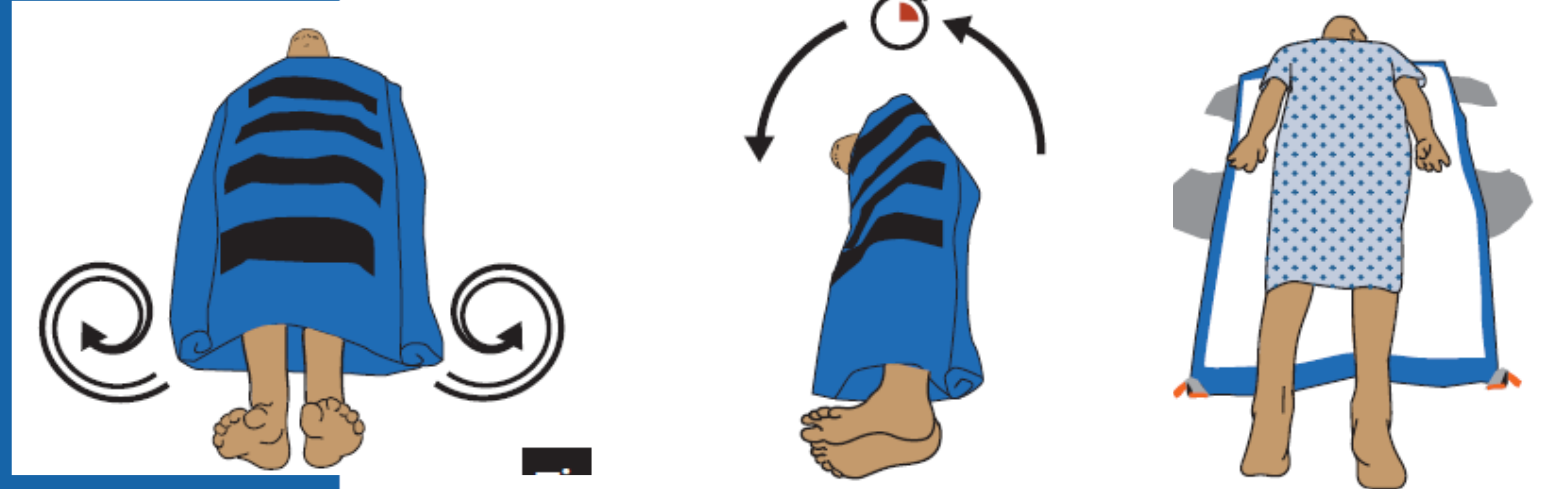
- Patient and family education
- Gather staff (5) and supplies, obtain pre prone measurements
- Preoxygenate, consider hold to empty stomach (1hr) if TF rate is high
- Suction endotracheal tube (if applicable)/oral cavity,
- Secure the endotracheal tube and lines (remove ET holders if in use)
- Position 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](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.

# Manual Proning



Mayo© 2017



Mayo© 2017

# Positioning Schedule & Maintenance Care<sup>1,2</sup>

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

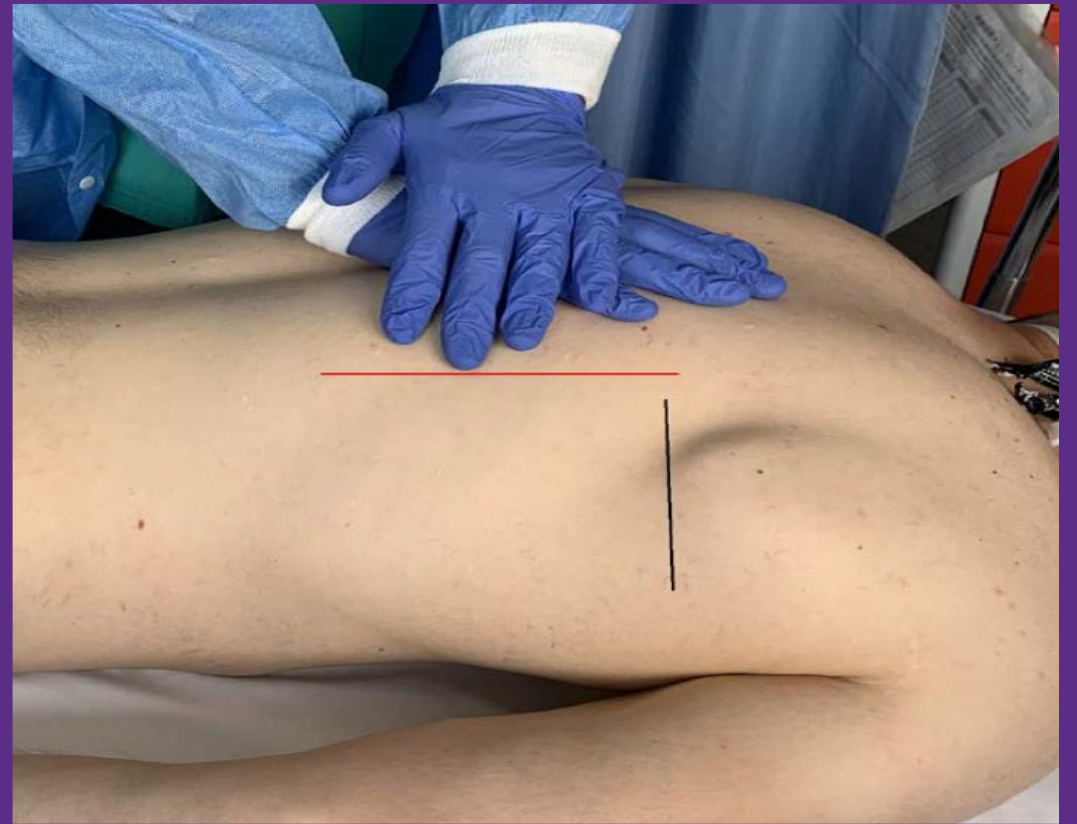




# ▶ CPR In the Prone Position

## ▲ AHA guidance

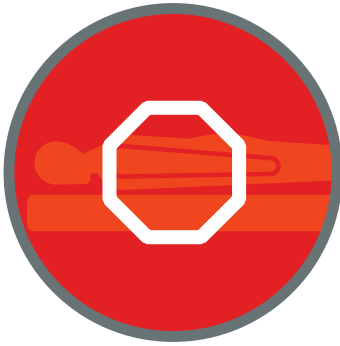
- △ If patient has advanced airway consider initiating prone CPR until team can safely turn supine
- △ Hand placement T7-T10
- △ If unable to transition patient to supine & defib is required
  - Pads in anterior and posterior position



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



# When to Stop Prone Positioning?



Research supports stopping prone positioning when  $\text{PaO}_2/\text{FiO}_2$  has remained  $>150$  mmHg 4 hours after supinating (with PEEP  $<10$  cm  $\text{H}_2\text{O}$  and  $\text{FiO}_2 <0.6$ )

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

# Awake Prone Positioning with COVID: Open Label RCT

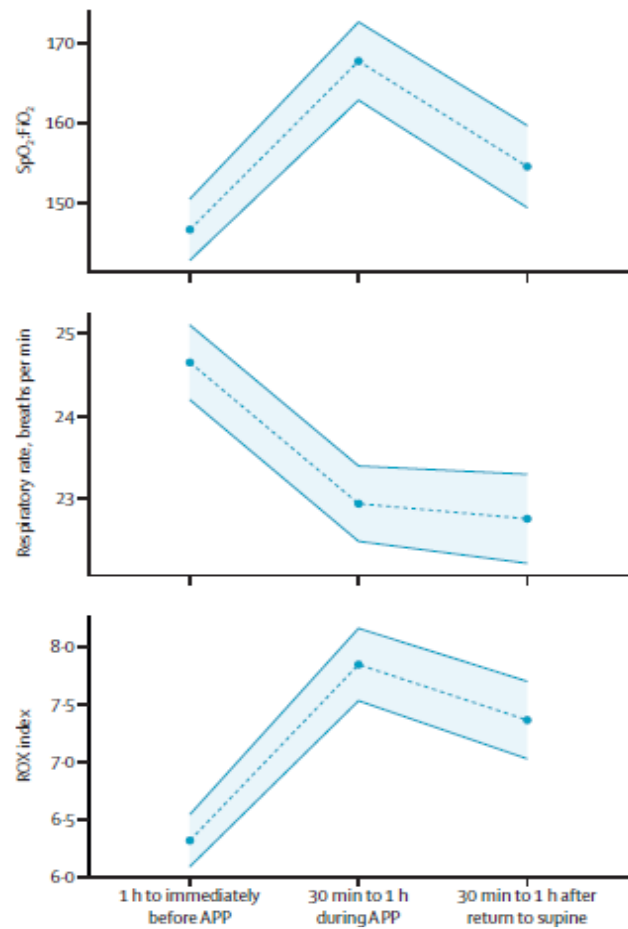
- ▲ Efficacy of awake proning to prevent intubation or death
- ▲ International open label RCT
- ▲ COVID 19 hypoxemic respiratory failure defined as: requiring respiratory support with HFNC & P/F ratio of  $\leq 315$  randomized to awake prone positioning or standard care
  - △ Awake prone (567)
  - △ 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



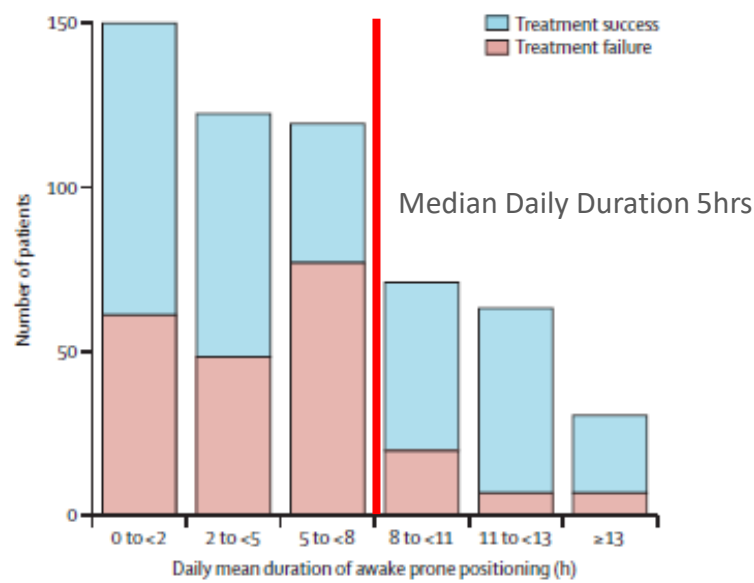
6 Countries: Mexico, US, Spain, Canada, France & Ireland

# Awake Prone Positioning with COVID: Open Label RCT

## Physiologic Impact of Awake Prone Positioning

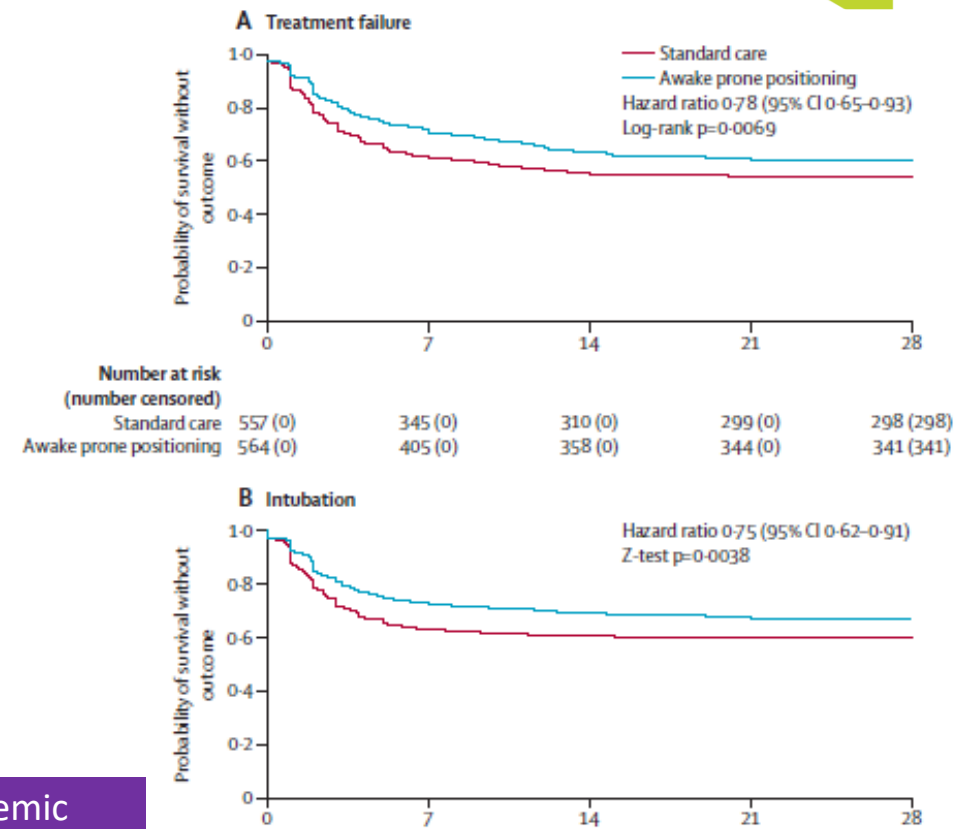


## Time Spent in Prone Position



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

## Outcomes





Adverse Events	No. of Trials Reporting the Outcome	Events/Prone	Events/Supine	Treatment Effect (Random-Effect Model)		Number Needed to Treat/Number Needed to Harm	Heterogeneity	
				OR (95% CI)	p		I <sup>2</sup> (%)	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 <sup>a</sup>	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

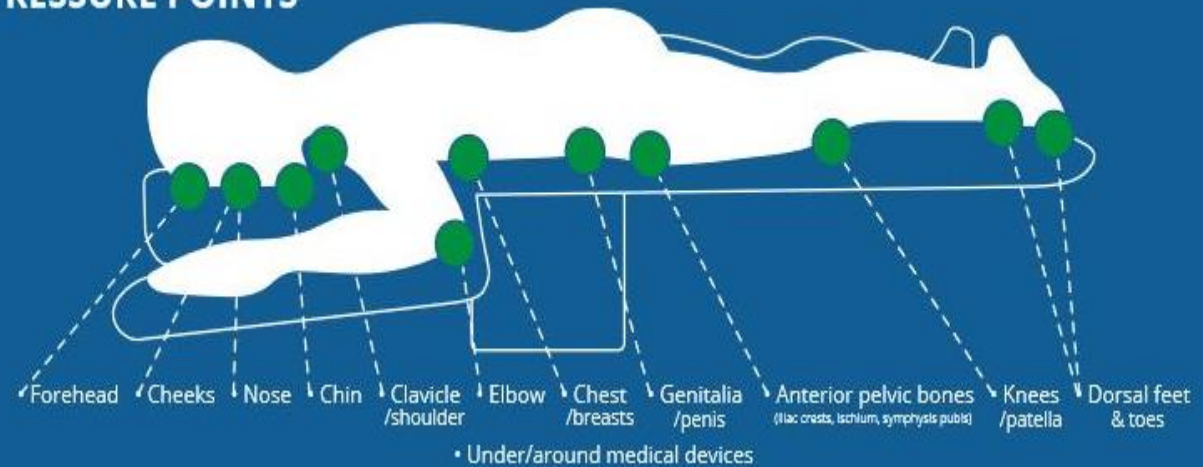
11.9% complication rate



# 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

## PRESSURE POINTS



Green areas represent pressure sources while lying prone

# 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)<sup>1</sup>
- 🌀 Turn the head q 2 hrs<sup>1</sup>
- 🌀 Manage moisture /oral & nasal secretions<sup>1,2</sup>
  - △ 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<sup>1,2</sup>
- 🌀 Apply thin foam dressings under medical devices—including ETT securement (tape-twill)<sup>1,2</sup>



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](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

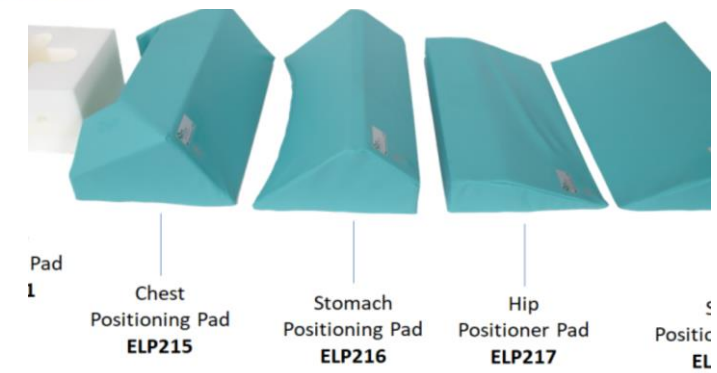
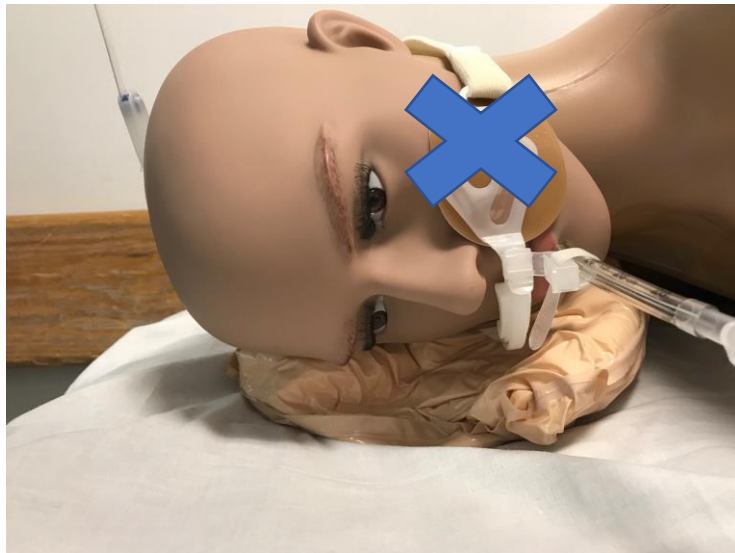
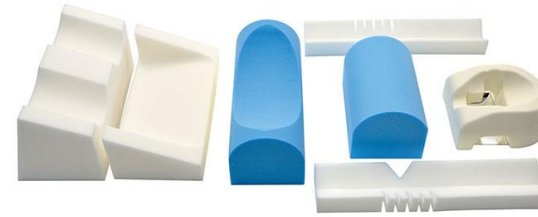


# Ocular & Brachial Plexus & Ulnar Safety



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





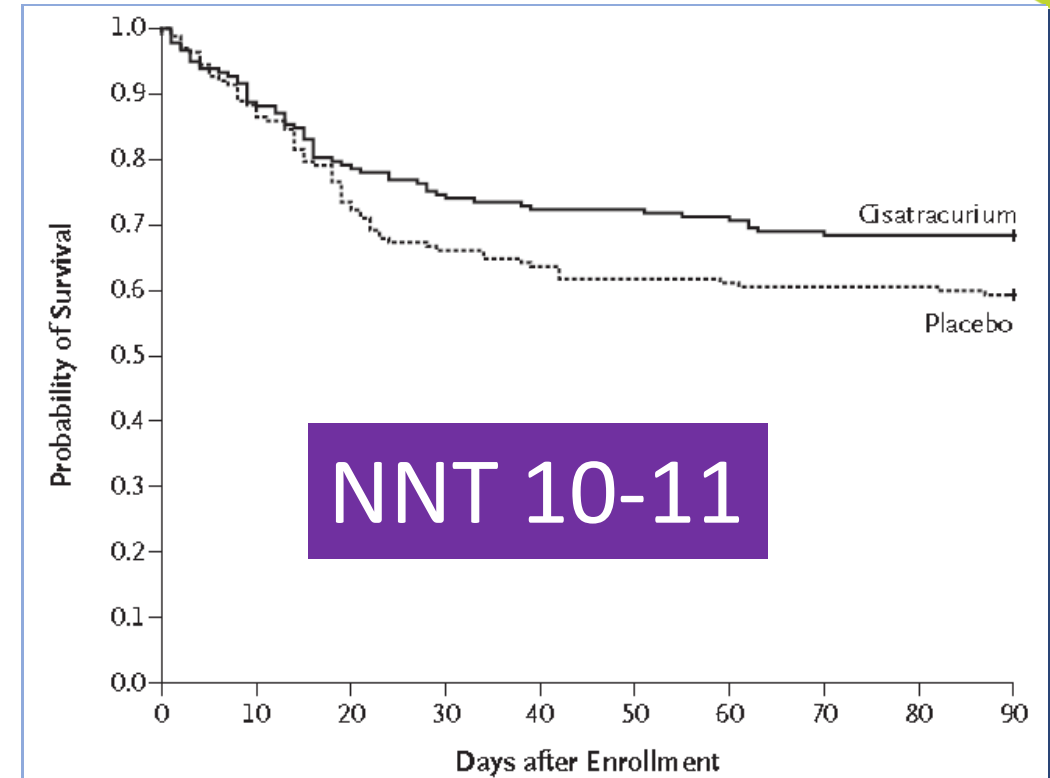
List various equipment available for prone (Fourie A, et al. *J Tissue Viability*. 2021;30(4):466-477.

# 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  $< 150 \geq$  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



# ROSE Trial: Re-evaluation of Systemic Early Neuromuscular Blockade

- Protocol: moderate to severe ARDS < 48hrs / P/F ratio < 150 with  $\geq$  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

# 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







**"HAPPY TURNING"**





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