Overview of Prone Positioning: Why It Works and Lessons Learned

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Objectives

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By the end of this webinar, the participants will

- recall at least 3 interventions to decrease tissue injury risk in the prone position.
- disseminate information on technique for proning from literature, evidence based protocols, and first-hand accounts to discern needs and best practice for their facility based upon facility size, experience of staff, and available equipment.
- describe recent evidence supporting prone positioning with Acute Respiratory Distress Syndrome, including outcomes and best practices.
- describe the basic pathophysiology and rationale behind prone positioning techniques for COVID 19 ARDS patients.

PHYSIOLOGY of PRONING

Meghan Lahart Gushurst, PT, DPT, CCS

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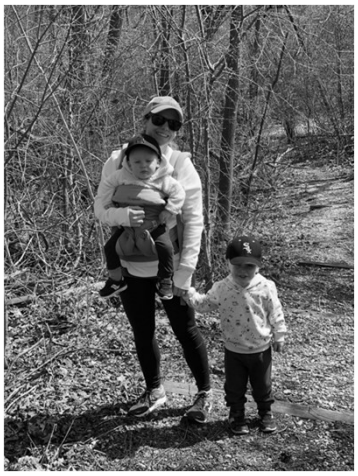
About the Presenter: Meghan Lahart Gushurst



- Board Certified Cardiovascular and Pulmonary Physical Therapist since 2014
- Has practiced primarily in the Cardiac ICUs for the last 10 years
- Currently the lead Physical Therapist in the COVID ECMO unit at Advocate Christ Medical Center in Oak Lawn, IL

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Disclosures

- Please refer to other webinars for further pathophysiology for COVID 19

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ARDS and COVID 19

- Acute respiratory distress syndrome first described in 1968 (Matthey et al, 2019)
  - acute hypoxemia
  - non cardiac pulmonary edema
  - decrease in pulmonary compliance
  - increase in work of breathing
- prevalence of ARDS in COVID-19 patients up to 17% (Chen et al, 2020)

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History of Proning

- Prone positioning used since 1970s
  - treat severe hypoxemia
  - improve gas exchange
- Mellins et al 1974 observed children with advanced cystic fibrosis positioned themselves on hands and knees to improve ventilation
- Two small case studies of ARDS demonstrated an increase in Pa02 with position change from supine to prone

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Prone & ARDS

- 2013 PROSEVA trial as well as results of multiple meta-analyses of RCTs firmly established prone use in patients with severe ARDS to improve mortality rates when applied early and for prolonged periods of time.

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How does Prone position work?

- Effect of prone position on chest mechanics
  - in supine pressure in the abdominal compartment exceeds those in the chest with the highest intra-abdominal pressure in the dorsal regions and therefore compress the dorsocaudal regions of the lung
  - prone positioning the weight of the heart comes off of the left lobe and onto the sternum

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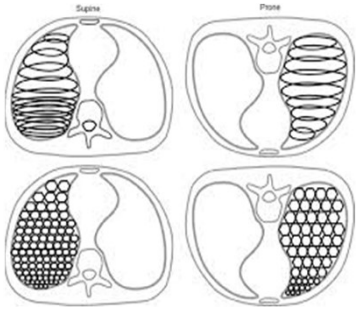
How does Prone position work?

- Ventilation/Perfusion Relationship
  - Slinky effect ie more spring coils gather at base of a vertically oriented spring
  - lung tissue density and pulmonary vasculature are greater in the dorsum of the lung in supine and bases when upright



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How does Prone position work?

- Alveolar Ventilation and Recruitment
  - decrease PaC02 possibly due to improved lung compliance from alveolar recruitment
  - posterior lobes have the greatest volume
  - in prone position gravity aides with the passive expansion of dorsal lobes
- Airway Secretion Clearance
  - several studies demonstrated secretion mobilization in patients in prone position that may improve oxygenation and alveolar ventilation

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How does Prone position work?

- Reduce incidence of ventilator-associated pneumonia
  - prolonged immobilization in supine position is associated with atelectasis and retained secretions in posterior lower lobes

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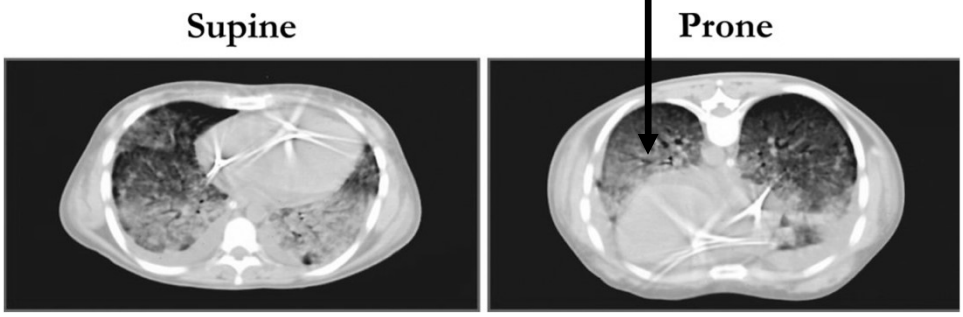
CT Image

In Prone
- Less abdominal compression on thorax
- Heart no longer compressing LLL



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Proning in NON-Ventilated Patients

- Prone positioning in patients not mechanically ventilated -- > improves oxygenation, decreases tachypnea, and can help alleviate dyspnea
- Prone positioning appears to help prevent or delay mechanical ventilation in patients w COVID-19

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Prone Positioning: A look at the evidence

Tricia Healy PT, DPT

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Academy of Acute Care Practice Committee

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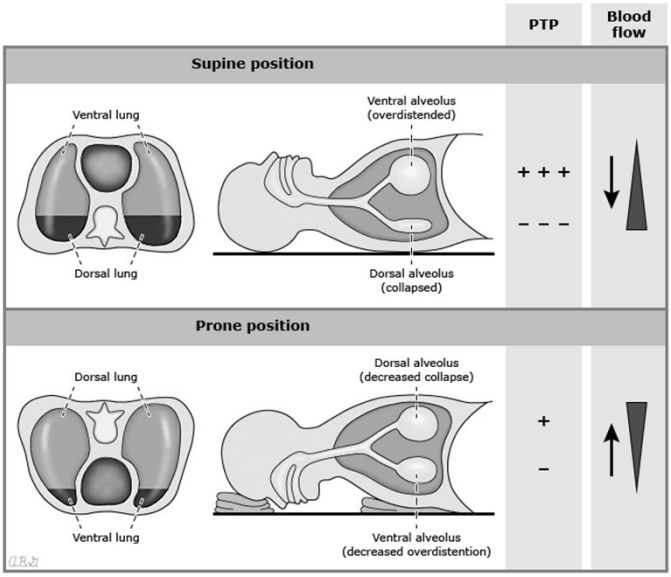

Prone Position

- Decrease in dorsal alveolar collapse
- Improved ventilation/perfusion matching

(Malhotra 2020)

Improved oxygenation

- Many trials have demonstrated that prone positioning increased PaO2 to allow a reduction in FiO2 (Malhotra 2020)
- Patients with diffuse pulmonary edema and dependent alveolar collapse are more likely to improve their PaO2 during prone than pts with fibrosis or significant consolidation.
- The improvement in oxygenation continues when the patient is returned to supine and may improve each time the prone position is repeated. (Henderson 2014)
  - Can classify response as persistent or non persistent

Evidence for Prone Positioning: The PROSEVA study- Proning and mortality

- A multicenter, prospective, randomized controlled trial of 466 patients with severe ARDS
- Randomly assigned to a supine group or prone group
- Prone group (sessions of at least 16 consecutive hours)
- Hospitals (in France and Spain) in the study has been using prone positioning in daily practice for more than 5 years

(Guerin 2013)

PROSEVA Study Outcomes

- Mortality at day 28 was significantly lower in the prone group (16% or 38 of 237 participants) vs. supine group (32.8% or 75 of 229) ($P<0.001$)
- The significant difference in mortality persisted at day 90
- Also the rate of successful extubation was significantly higher in the prone group (80.5%) vs. supine group (65%) (Guerin 2013)

Other evidence: When to initiate prone positioning

- Ventilation in the prone position is recommended early in moderate to severe ARDS. (Koulouras 2016)
- Literature supports the use of prone positioning in the early management of ARDS, not as a rescue maneuver or last ditch effort. (Koulouras 2016)
- After a 12-24 hour stabilization period of supine ventilation, recommend initiating prone positioning early in the mechanically ventilated patient with ARDS. (Malhotra 2020)

Duration of prone positioning

- Literature recommends maintaining prone positioning for 18-20 consecutive hours (Malhotra 2020)
- A response (improvement in gas exchange) can be noted in the first hour
- Continue to prone until signs of improved oxygenation or need for prolonged interventions/surgery. (Malhotra 2020)
- In the PROSEVA study, prone ventilation was continued (up to 28 days) until continued improvement in oxygenation was sustained for at least 4 hours after the end of the last prone session. (Guerin 2013)

Recent evidence re: Prone Positioning and COVID-19

- *Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19)*

Recommendation-

- For mechanically ventilated adults with COVID-19 and **moderate to severe ARDS**, we ***suggest*** prone ventilation for **12 to 16 hours**, over no prone ventilation. (Alhazzani 2020)
- No studies (yet) that describe the clinical course of patients with COVID-19 who were proned.

Surviving Sepsis Campaign

- Proning and COVID-19:
- Guidelines
  - aim to decrease risk of pressure sores and ETT obstruction
  - need for staff training
  - each institution should develop protocols based on their resources

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- Academy of Acute Care PT Practice Committee
- Practice Areas of Focus/Interest
  - ICU Rehab
  - Care of Complex & Multi-Admission CVP patient
  - Acute Vestibular Dysfunction Evaluation and Treatment
- One of four hospital COVID19 lead therapists
  - Collaborative interdisciplinary creation of hospital proning protocol for mechanically ventilated patients with COVID19 and interdisciplinary staff training

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Forming the Prone Positioning Team

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Disclaimers

Views and educational content provided in this webinar is not a direct representation of the views or protocols of Northwestern Medicine and are solely based upon research/review of current literature and firsthand experiences of presenter during the implementation of prone positioning and training of staff. Any products discussed during the presentation are not directly endorsed by the presenter nor endorsed by Northwestern Medicine.

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Prone Positioning: Myths, Facts, Reality

Myth: Prone positioning is a passive activity, skilled therapy is not involved, so PT/OT shouldn't do it

Not exactly, It depends….

Global Partners, what did they recommend?

- Early recommendations from across the globe
  - Physiotherapists are the profession primarily responsible for respiratory care in addition to mobility and exercise training
  - Many international journals have cited teams made up of physiotherapists, nurses, and physicians
- Scope
  - "It is recognized that physiotherapy practices vary across the world. When using these recommendations, the scope of practice within the local context should be considered" (Thomas P., et al 2020)

"The team should comprise six members: a physician, a physical therapist, a nurse, two technicians, and a physical therapist or nurse or technician responsible for reading and checking all checklist items."

Oliveira VM, et al. 2017

Revista Brasileira de Terapia Intensiva

Global Partners, what did they recommend?

Prone positioning

3.15 Physiotherapists may have a role in the implementation of prone positioning in the ICU. This may include leadership within ICU 'prone teams', providing staff education on prone positioning (eg, simulation-based education sessions) or assisting in turns as part of the ICU team.

- Thomas P., et al 2020 cited physiotherapists as having a potential role in ICU during COVID19 as pertaining specifically to prone positioning

Global Partners, what did they recommend?

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.

- Oliveira VM, et al. 2017 included physiotherapists in their prone positioning protocol, citing their role in tube suction, oxygenation and positioning

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)

Prone Positioning: Myths, Facts, Reality

Fact: Many larger Level I Trauma centers typically have years of experience with the critically ill and prone positioning for severe ARDS

- These hospitals will either have experienced trained RN staff that regularly complete mobility and repositioning for patients on mechanical ventilation or have a designated prone team
- Designated prone teams sometimes include PT/OT, policies vary from facility to facility

Prone Positioning: Myths, Facts, Reality

Reality: Smaller community-based hospitals may not have as much experience with the critical level of illness currently seen in patients with COVID19, especially when it comes to repositioning and mobility needs of those on mechanical ventilation

- These hospitals should, as staffing allows, consult with PT/OT or integrate them into the team

What does PT/OT bring…

As a Consult

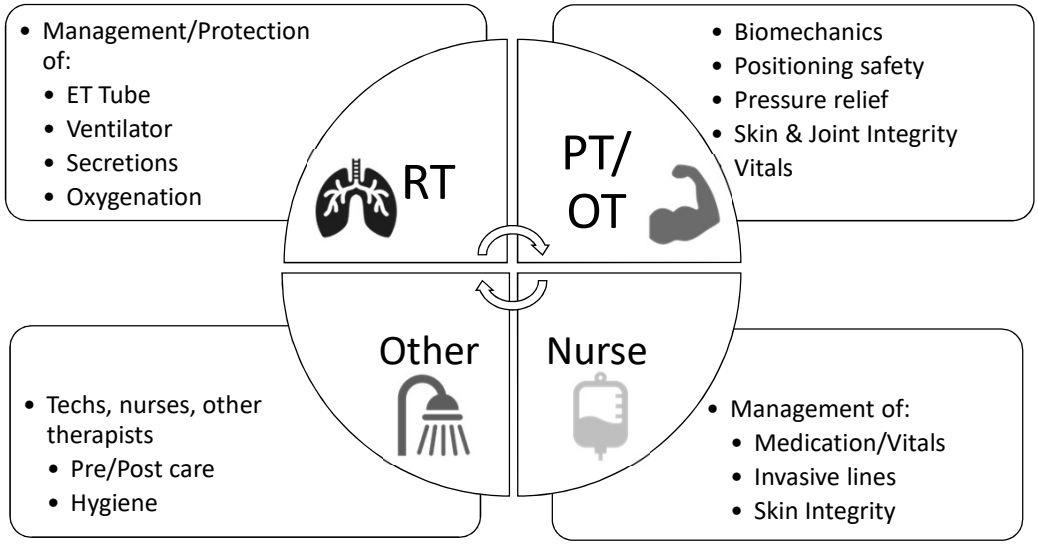
- Post positioning
  - Recommendations for repositioning/alignment
  - Pressure relief

Prone Team Member

- Real time protection/assessment of
  - Joint integrity
  - Pressure relief
  - Staff body mechanics
  - Vital sign response
  - Secretion management, Suctioning
  - Injury Risk (staff v patient)

Bamford, P et. al 2019 *Guidance for: Prone Positioning in Adult Critical Care*

Prone Team Members, 5 minimum



Manual Prone Positioning Technique

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Variations

- As mentioned in Tricia's section, the 2013 journal article by NEJM set the standard and included an open access video to instruct prone positioning.
  - Since then technique has evolved to include the "burrito" or "swaddle" method
- Some facilities utilize specialized equipment to assist in turning, this is further covered by Stephanie in the next section
- The protocol for your facility should be a collaborative effort combining techniques from other facilities and realistic practices based on available staffing, equipment, and patient population

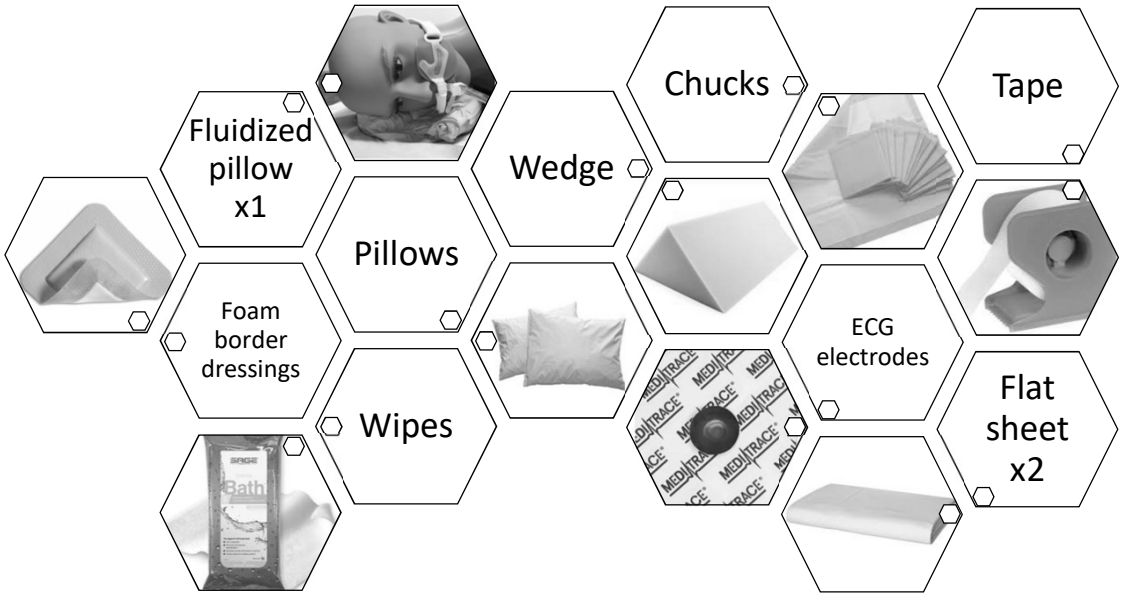
Phase I- Pre Prone Meeting

- Notify Prone Team or gather trained available staff
- Gather Shopping List items
- Decide on team leader

Some facilities have placed IV poles outside rooms to minimize entry and save PPE. Have additional RN available to titrate meds as needed

Bamford, P et. al 2019 *Guidance for: Prone Positioning in Adult Critical Care*

Shopping List



Phase II- In Room Prep

RN/PT/Tech

- Stop tube feeds
- Lower all rails, raise height of bed
- Place
  - Lines above waist to HOB
  - Lines below waist to foot of bed
  - Foley & Rectal tubes between feet
- Remove SCDs, pillows, wedges, gown
- Cover genitals with chuck
- Head to toe skin assessment
  - Clean skin and remove adhesives
- Apply
  - Foam to bony prominences
  - Paper tape to eyelids to protect eyes
- Place flat sheet on top
- Final check to ensure all lines, tubes, and wires are secured

RT

- Remove Headboard
- Pre-oxygenate with 100% O2
- Lower head rails and adjust vent position to allow for slack in tubing/lines
- Oral Care
  - ET tube Suction
  - Oral Suction
  - Nasal Suction

Phase III- Executing Prone Position

- Flatten head of bed & remove pillow
- Remove ECG leads & electrodes
  - Arterial line and tissue oximetry can be used for pulse monitoring
- Tuck hands underneath hips
- RN and Staff roll sheets together swaddling patient like a “burrito”

Bamford, P et. al 2019 *Guidance for: Prone Positioning in Adult Critical Care*

Phase III- Executing Prone Position

- RT will place hand farthest from vent underneath occiput to support skull and neck
- Hand closest to vent will support ET tube and head by placing palm under chin and wrapping fingers around ET tube

Bamford, P et. al 2019 *Guidance for: Prone Positioning in Adult Critical Care*

Phase III- Executing Prone Position

When all staff agree that they are ready, lead staff will count to 3 for each…

Boost patient to head of bed, pause	Boost patient horizontally to EOB farthest from vent, pause	Log roll to 90 degrees side lying, ET tube pointed towards ventilator, pause	Staff opposite ventilator, pull sheet underneath to rotate patient into prone. Staff on the side of ventilator lowers patient into prone

RT maintains head facing toward vent as allowed by neck ROM from side lying through prone positioning

Phase III-Executing Prone Position

Bamford, P et. al 2019 *Guidance for: Prone Positioning in Adult Critical Care*

Phase IV-Post Prone Care

- New ECG electrodes applied to back and leads attached
- 2 staff at shoulders and RT at head stabilize and lift chest from bed to place wedge underneath chest just below clavicle and fluid repositioner under head
  - Alternately some facilities may elect to preemptively place pillows on chest and hips prior to proning in burrito roll to provide chest elevation.
- Elevate feet with a single pillow parallel under each shin, add wedge if needed
- Ensure all lines and tubes are clear, loose, and free of potential harm
  - RN to level and zero invasive monitors

Bamford, P et. al 2019 *Guidance for: Prone Positioning in Adult Critical Care*

Phase IV-Post Prone Care

- Place pillow/towel roll underneath shoulders to place in neutral position, avoid over protraction/retraction
- Skin safety assessment, clean and apply dressing/treatment as needed
- Place fresh gown over patient or chuck over buttock
  - Ensure for male patient that genitals are clear and free of pressure
- Cover with clean flat sheet
- Secure wrist restraints
- RT to provide additional secretion management as needed
- Raise all rails
- Reverse Trend patient, per RN discretion
  - 10—20 degrees is advised

Bamford, P et. al 2019 *Guidance for: Prone Positioning in Adult Critical Care*

Swimmer's Position, to do or not to do…

- IT DEPENDS
- Not all body types and available PROM will allow for swimmer's position especially if the patient has
  - history of cervical stenosis
  - significant neck edema from prolonged intubation
- Consider body size/type and available space on bed. May have to utilize bedside tray to extend width to support arm
- Use clinical judgement and skilled therapy brain to determine optimal positioning, patient may require additional chest support to improve lordosis in neck

Additional Considerations

- Most checklists call for Q2 repositioning of head/arms
  - Goal in COVID19 care is to save PPE and reduce vectors of exposure, consider Q4 vs Q-Shift
  - Utilize lateral tilt function of bed if available to provide additional offloading
- If it is determined that PT/OT will not be part of repositioning process consider instituting rounds to visualize positions and advise care team as needed
- X-ray of chest should be evaluated by MD prior to prone positioning to ensure ET tube is in correct position.

Conscious Prone Positioning

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Patient inclusion criteria

- Respiratory symptoms (e.g. cough, shortness of breath)
- Relative hemodynamic stability
- Able to adjust own position
- Communicates independently
- SpO2 ≥ 90% with room air or oxygen via nasal cannula
- No contraindication to awake prone positioning

Bamford, P. et al *Guidance for Prone Positioning of the Conscious COVID Patient 2020*

Absolute Contraindications

- Respiratory distress
  - RR >35 PaCO2 ≥ 6.5
- Immediate need for intubation
- Spinal instability, pelvic fractures
- Severe burns or large open wounds on face or ventral surface
- Open chest or unstable chest wall
- Elevated intracranial pressure
- Severe hemodynamic instability
  - SBP <90 mmHg or new cardiac arrhythmia
- High risk for aspiration

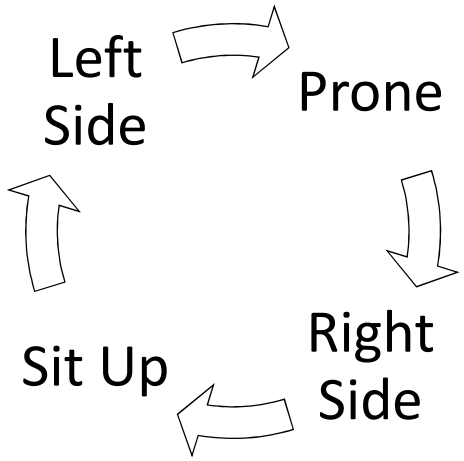
Relative Contraindications

- Facial Injuries
- Neurological issues
  - Frequent seizures
- Morbid Obesity
- Pregnancy (2/3rd trimester)
- Pressure sores/ulcers

Bamford, P. et al *Guidance for Prone Positioning of the Conscious COVID Patient 2020*

Conscious Prone Protocol

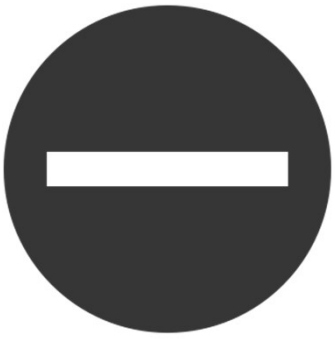
- Explain procedure/be benefits to patient
- Monitor O2 saturation continuously
  - If SpO2 92-96% continue as tolerated
- Patient to change positions every 30 minutes to 2 hours as tolerated while awake
  - Monitor SPO2 for 15 min after each position change



Bamford, P. et al *Guidance for Prone Positioning of the Conscious COVID Patient 2020*

When to stop prone positioning

- RR improves, no further O2 needs, no further complaints
- Deterioration
  - No improvement with position changes
  - Patient unable to tolerate position
  - RR $\geq$ 35, patient looks tired, uses accessory muscles



Bamford, P. et al *Guidance for Prone Positioning of the Conscious COVID Patient 2020*

Video Resources

- https://www.youtube.com/watch?v=E_6jT9R7WJs&t=6s Original Video Instruction 2013 NEJM
- https://www.youtube.com/watch?v=ECdxhNFLwVo March 31, 2020 Mount Sinai COVID19
- https://www.youtube.com/watch?v=lcBPaHQUvXY&t=54s April 2, 2020 Rush University Medical Center

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- Assistant Professor – USC Division of Biokinesiology & Physical Therapy
- Prone Team -- Keck Hospital of USC

APTA Academy of Clinical Electrophysiology & Wound Management

USC Physical Therapy

Special Considerations for Skin in the Prone Patient

- Potential for higher PI risk
  - Role of oxygen deficit
- Prone positioning can last anywhere from 8-20 hours
  - Need to make small shifts in body position & re-position head every 2-4 hours
- Major complications of proning patients with ARDS include:
  - ET tube displacement
  - Pressure injury
  - Loss of venous access
- Proning with patients also on ECMO

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Beds and Positioning Devices

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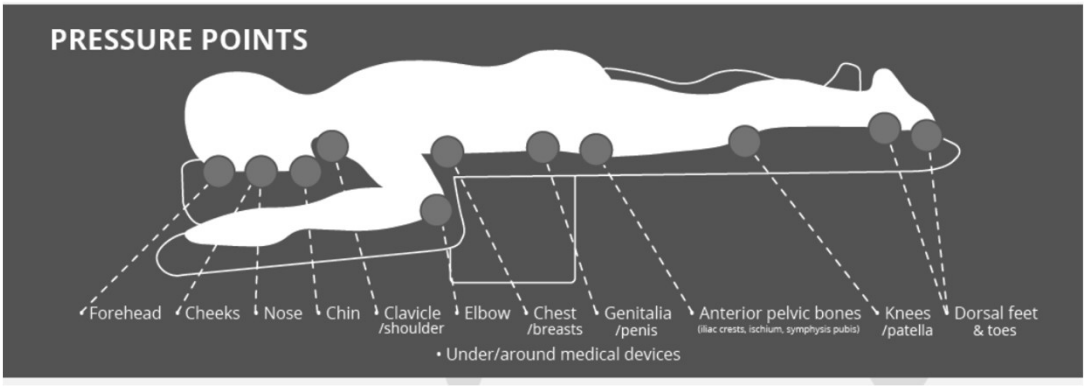
Prone Pressure Points



NPIAP, 2020

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2019 International Pressure Injury Guideline Recommendations

- Repositioning
  - Determine frequency based on individual
  - Consider using continuous bedside mapping as a visual cue
  - Use soft silicone multi-layered foam dressings for protection
  - Do not use ring or donut-shaped positioning devices
  - Initiate frequent small shifts to supplement regular repositioning
- Medical Devices
  - Regularly monitor tension of securement areas
  - Avoid multiple layers of dressings that increase pressure
  - Regularly rotate or reposition the device if possible
  - Avoid positioning directly on medical devices

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Other Skin Manifestations in COVID-19

- May appear similar to cutaneous manifestations in other viral infections
- Casas et al. (2020)
  - Prospective study of 375 cases
  - Acral areas of erythema with vesicles or pustules – 19%
  - Other vesicular eruptions – 9%
  - Urticarial lesions – 19%
  - Maculopapular eruptions -- 47%
  - Livedo or necrosis – 6%
- Acral areas of erythema frequently appear late in the evolution of the COVID-19 disease (59% after other symptoms)
- Remainder of skin manifestations tend to appear with other symptoms of COVID-19.
- Severity of COVID-19 shows a gradient from less severe disease in acral lesions to most severe in the latter groups.

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Vascular Skin Manifestations in COVID-19

- Bouaziz et al. (2020) – retrospective observational study (n=14)
  - 50% of patients with inflammatory lesions as previously described
  - 50% of patients with vascular lesions
    - Violaceous macules
    - Livedo
    - Non-necrotic purpura
    - Chilblain
    - Eruptive cherry angioma

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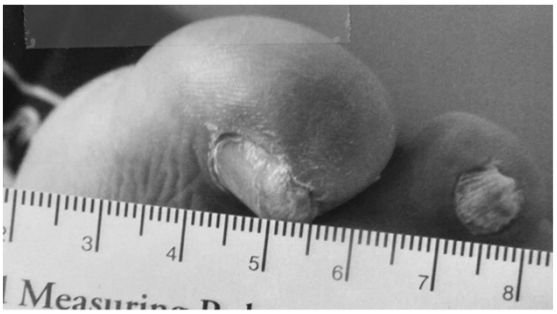
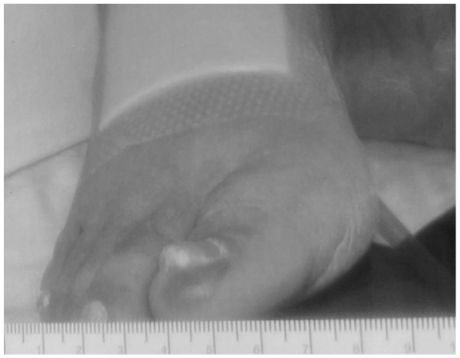
COVID toes?





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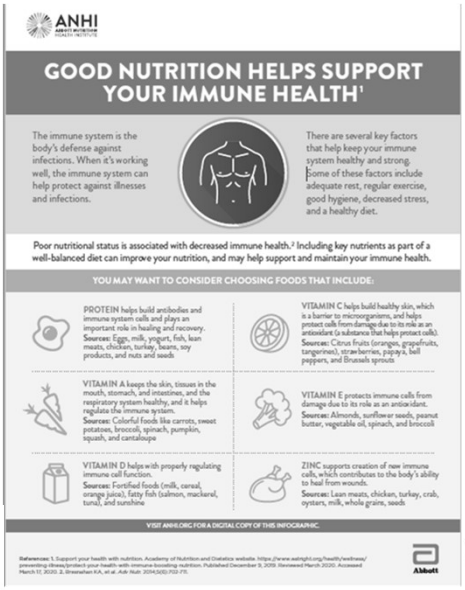
Additional Considerations

Nutrition Considerations



Abbott Nutrition Health Institute, 2020

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Post-Acute Skin Considerations

- Re-consider admission skin assessments/integumentary evaluations
  - Definition of "at-risk" areas

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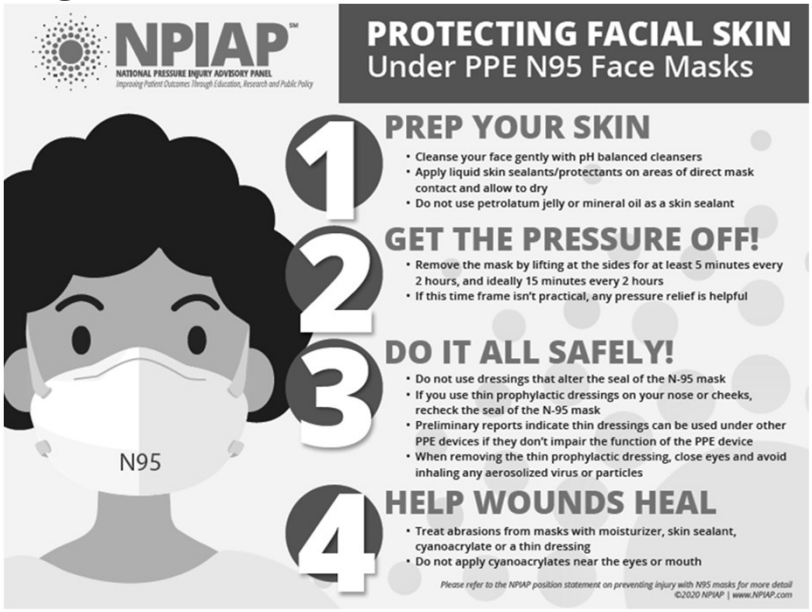
Caregiver Skin Considerations



"The essential function of a Personal Protective Equipment (PPE) mask (i.e. to prevent COVID-19 transmission from patient to provider) ***cannot*** *be compromised."*

--NPIAP Position Statement on Preventing Pressure Injury with N95 Masks, 2020

NPIAP, 2020

Lessons Learned -- Teamwork

- Decide what "team" works for you
  - On-call?
  - Scheduled times?
  - 24/7?
  - Small group of dedicated staff vs. training for all?
- Start with safety and go from there
  - Embrace opportunities for collaboration and problem-solving
  - Rare that one protocol will cover 100% of patients
  - Maintain focus on decreasing variation

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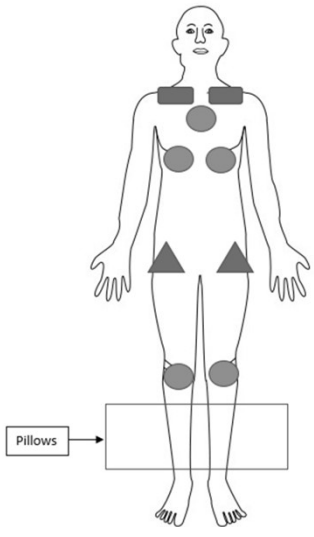
Lessons Learned – Prone Kits



Clavicles	▭	6" border (2)
Sternum	●	4" border (1)
Chest/Ribs	●	4" border (2)
Iliac crests	▲	7" sacral dressing (2)
Knees	●	4" border (2)

*Date dressings on day first applied – will change Q3 days

Needed Supplies:

- 6" border – 2
- 4" border – 5
- 7" sacral dressing – 2
- pillow – 1
- Electrode set – 1
- Pillows for under shins – 2
- boots -- 2

- Skin under Mepilex dressings is to be checked following each episode of prone positioning by peeling the dressing back to assess skin and then putting same dressing back in place.
- Mepilex dressings to be changed Q3 days and PRN.

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Lessons Learned – Off-loading

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