



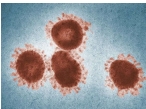
What does COVID-19 do to the Skin?

Joyce Black PhD RN DAPWCA FAAN

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COVID-19 Pathophysiology

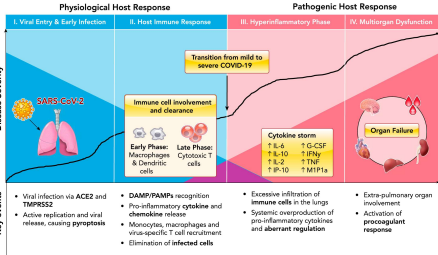
- Coronia virus is less then 125 nanometers (.125 microns) in size
- Attaches to angiotensin-converting enzyme-2 receptors
 - The point of viral entry into the cells in respiratory and GI tracts
 - Receptors also in skin, blood cells, kidney
- Leads to hypercoagulable state with high rates of VTE, PE, and MI
 - Also mesenteric ischemia and lower limb ischemia
 - Can evolve in to DIC
- Leads to massive inflammation – “cytokine storm”
 - Prompted by Interleukin-6
 - Blocks interferon I and III
 - Interferons “interfere” with viral replication



Bourgonje AR et al., Angiotensin converting enzyme, SARS-Cov-2 and pathophysiology of coronavirus disease 2019 (COVID-19). J Patho, 2020, preprint version. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/path.5471>
COVID-19 and the use of angiotensin converting enzyme inhibitors and receptor blockers, WHO, May 7, 2020

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COVID-19 Host Response



The diagram illustrates the progression of COVID-19 host response over time, divided into four phases: I. Viral Entry & Early Infection, II. Host Immune Response, III. Hyperinflammatory Phase, and IV. Multisystem Dysfunction. It shows the transition from mild to severe COVID-19, highlighting key events such as viral infection via ACE2 and TMPRSS2, immune cell involvement, cytokine release, and organ failure. Key events include: Viral infection via ACE2 and TMPRSS2; Active replication and viral release, causing pyroptosis; DAMP/PAMP recognition; Pro-inflammatory cytokine and chemokine release; Monocytes, macrophages and virus-specific T cell recruitment; Elimination of infected cells; Excessive infiltration of immune cells in the lungs; Systemic overproduction of pro-inflammatory cytokines and aberrant regulation; and Extra-pulmonary organ involvement leading to activation of procoagulant response.

Bohn, MK et al. Pathophysiology of COVID-19: Mechanisms underlying disease severity and progression. Physiology, 2020, August 12

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COVID-19 in Darkly Pigmented Persons

- Decreased absorption of vitamin D because sunlight is blocked by melanin
 - Many chronic cardiac diseases are associated with lack of vitamin D
- Deficiency of ACE2 receptors that should protect them from the disease as the virus could not enter the cells
- However, once virus does enter the cell it causes over activation of the renin system
 - Worsening of inflammation and thrombosis
- When combined with increased risk for cardiac disease the development of complications and death is much higher

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Skin Changes with COVID-19

- Accelerated clotting and tissue ischemia create purpuric tissue
 - Not only on areas exposed to pressure
 - Higher risk of clotting problems in persons with darkly pigmented skin
 - Purpuric skin lesions may be a warning sign of serious coagulopathies such as PE
- Often extremely ill
 - Septic/septic shock/vasopressors
 - Higher risk of clotting problems in persons with darkly pigmented skin
 - Many abnormal labs
- Purpuric skin rashes may be a warning sign of serious coagulopathies such as PE, stroke, etc

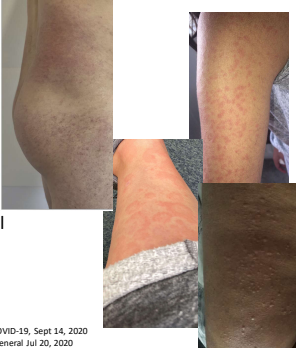


Images provided by Beaumont Hospital

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Many Skin Problems

- Urticaria with hives early in the disease
- Macular-papular rash which lasts for weeks
- Petechia
- Purpuric skin lesions in the critically ill
- Mottling of the skin
- COVID-toes or acro-ischemic lesions



King's College London. Skin rash should be considered as a fourth key sign of COVID-19, Sept 14, 2020
Cunningham, J. Range of COVID-19 skin signs linked to disease severity, Mass General Jul 20, 2020
Jimenez-Cauhe J et al, Eranthem in patients with COVID-19 and skin rash. JAMA Derm July 15, 2020

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“COVID toes” are embolic– not pressure

EARLY LESIONS:



WITH 7 DAY PROGRESSION:



7


Pressure Injury in Ischemic/Sheared Skin

- High-Fowler's position increases shear forces on lower sacrum and buttocks
 - Support surfaces do not address this risk well
 - Preventive dressings often not placed that low on buttocks
- Deep Tissue Pressure Injury evolves for 48 hours before being visible in the skin
 - Home during this time?
 - Delayed in ED?
 - In non-ICU bed?
- DPTI visible once prone



Images provided by Beaumont Hospital

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Preventing Pressure and Shear Injury

- Place preventive dressing upside down and lower on buttocks
- Elevate heels from the bed
- Pad skin under medical devices
- Support surfaces not well designed to reduce pressure and shear on the lower buttocks
- Avoid continuous lateral rotation – shear forces high
- When turning, confirm that sacrum is off of the bed

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NPIAP Position Paper on COVID Skin Changes

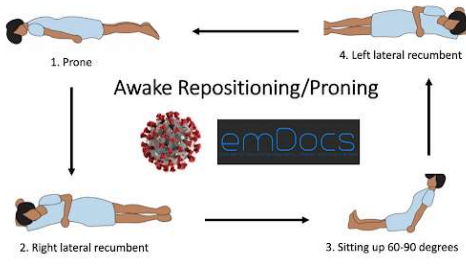


Skin Manifestations with COVID-19: The Purple Skin and Toes that you are seeing may not be Deep Tissue Pressure Injury.
An NPIAP White Paper


Accelerated clotting leads to purple changes in skin not exposed to pressure... these are not deep tissue pressure injury
Ischemic skin from clotting cannot reperfuse when patient is prone or turned, these pressure injuries are unavoidable

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Matching Perfusion and Ventilation

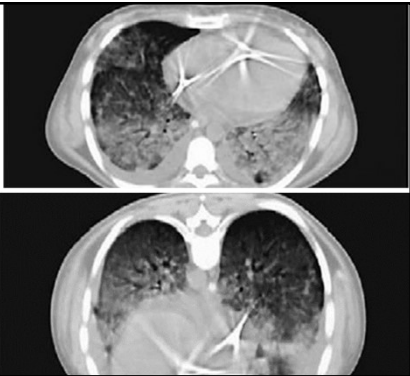


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Prone Patients is Saving Lives – but Increases Risk of Pressure Injury

- Why prone?
 - Improved ventilation to perfusion ratio
- When to prone?
 - Patients with mod-severe ARDS (PaO2/FiO2 < 150 mm Hg)
 - Early in the course (12-24hrs)
 - Mean arterial pressure > 65 mm Hg
 - Consider using neuromuscular blockade in the presence of ventilator asynchrony



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DTPI in Prone Patients


- Anterior surfaces of the body are
 - Poorly padded
 - Highly visible
- Prone position for ARDS increased odds of PrI
 - Ranges 1.22- 1.37 (95% CI 1.05 to 1.79)

Bloomfield R, et al. Prone position for acute respiratory failure in adults. Cochrane Database Sys Rev, 2015, 11 CD008095.
Mora-Arteaga JA et al. The effects of prone position ventilation in patients with acute respiratory disease syndrome. A systematic review and meta-analysis. Med Intensiva, 2015, 39 (6), 359-372.
Munshi L, et al. Prone position for acute respiratory distress syndrome: a systematic review and meta-analysis. Ann Am Thorac Soc, 2017, 14 54, S280-S288.

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Preventive Skin Care Begins Prior to Proning

- Support surface should be designed for ICU patients
 - Add a static air or reactive air overlay to bed before prone
 - Plan to do micro-shifts while prone
- Remove commercial ET tube holder, tape ET in place
- Lubricate eyes with eye ointment and tape closed
- Apply dressings around the face
 - Use highly absorptive dressings on the chin
 - Or plan to change them often



Jackson M et al. Skin preparation process for the prevention of skin breakdown in patients who are intubated and treated with RotoProne. Respir Care. 2012 ; 57 (2) : 311-314 .
Kim R & Mullins K. Preventing facial pressure ulcers in acute respiratory disease syndrome (ARDS). J Wound Ostomy Continence Nurs 43 (4), 427-429.
Vollman K. The chapter sent from AACN

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Stablizing the ET tube with Tape

- Several You-tube videos on how to prepare the tape
 - Nonstick on the back of the head
 - Loops around the tube
- Commercial tape products available



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Apply Prophylactic Dressings Prior to Proning

- Apply preventive dressing to all high-risk areas
 - Areas depends on body habitus and gender
 - Pad any devices that the patient will be lying on while prone
 - Existing dressings in your supply will work



Haggard, C., Luepar, B., Mathews, L. & Weaver, S. (2018) Prevention of perioperative hospital acquired pressure injuries: Prone and Park-Bench position for neurosurgical procedures. Vanderbilt Medical Center, Nashville TN

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Getting the Patient into Prone Position – Use a Check List and a Proning Kit

- Rule out contraindications
- Establish enteral feeding tube into small bowel
 - May be omitted if urgent
- Remove headboard from bed
- Assemble team
 - "Airway Manager" at head of bed
 - 2 staff on each side of the bed
 - Others to manage tubes/lines prn
- If pt paralyzed use extreme caution not to injure shoulder or neck
- **Safety check here**
 - Review plans for accidental extubation
 - Review need to rapidly turn if arrests
 - Equipment is present to replace lines or tubes prn

- Remove chest electrodes
- Move lines and tubes up toward patient head or down (if below waist)
- Remove ETT holder and tape ET tube in place and identify position of tube at the teeth
- Position pillows or dressings on high risk areas
- Cover patient with turn sheet or Tortoise
 - Head exposed, turned toward ventilator
 - Arms at sides
- **Safety check here**
 - Review patient's body for safe move
- **Slide patient away from ventilator**
- Turn toward ventilator to perpendicular position
 - Reassess lines and tubes
- Turn prone
 - Check position of ET tube
 - Position arms and face

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Mass General's Turning Team




PRONE: Face Down, O2 Saturations Up!

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Positioning the Head and Arms while Prone

- Place head on a positioner
 - Create an indent to allow ventilator tubing to exit without bend or pressure
- Turn head to the side
 - Shift head position every 2 hours
 - Face should not be hanging down
 - Rotate side to side every 4 hours along with arms
 - Carefully check position of ET tube
 - Change dressings if wet from saliva
 - Carefully check position of dependent ear
- Place arm into swimmer's position
 - One arm is up, one is down
 - Avoid movement beyond ROM
 - Avoid extreme stretch of the head and downward pull the arm to prevent brachial plexus injury
 - Avoid extreme extension or rotation of the shoulder to prevent rotator cuff injury



Barakat-Johnson M et al. Pressure injury prevention for COVID-19 patients in a prone position. Wound Practice and Research 2020; 28(2):50-57. DOI <https://doi.org/10.3325/wpr.28.2.50-57>

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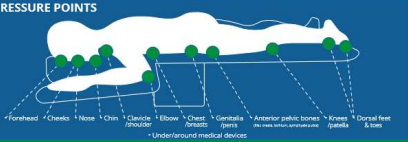
PRESSURE INJURY PREVENTION

PIP Tips for Prone Positioning

GENERAL TIPS

- Use a **pressure redistribution surface** (for those not on a bed specifically designed for prone)
- Follow manufacturer instructions when using beds, positioning devices, prophylactic dressings and other products.
- Positioning devices**/pillows are needed to offload pressure points.
- Involve enough trained staff to avoid friction/shear when repositioning. May reposition into swimmer position.
- Microshifts and small position changes should be performed while prone, especially in non-rotating beds.
- Assess all **pressure points**:
 - Prior to proning (anterior surfaces). Prior to returning to supine position (posterior surfaces).
 - When alternating arm position in swimmer arm position, assess integrity of skin of arm/head/face.
 - Document all skin assessments and preventive measures.

PRESSURE POINTS



Under/around medical devices

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PAY SPECIAL ATTENTION TO THE FOLLOWING AREAS

HEAD

- Apply soft silicone multi-layered foam **prophylactic dressings** to pressure points on face.
- Manage moisture**: Suction oral secretions. Use liquid skin protectant/balms on face. Change foam dressing qm. Apply hydrofiber/calcium alginate dressing under prophylactic dressing to manage excess moisture.
- Apply **thin foam dressings under medical devices**. Avoid multiple layers of dressings that increase pressure.
- Offload head** with offloading device(s): Consider the density of foam, height of the cushion, angle of the face, and endotracheal tube (ETT) positioning when selecting an appropriate device.
- With manual proning, **shift patient's head** q 2 hours; re-position head q 4 hours. May adjust timing to patient needs.
- Note: commercially available ETT securement devices may contribute to increased skin breakdown in prone patients. Assess skin carefully. Consider tape to secure ETT during proning.
- Maintain **eye care** to prevent corneal abrasions. Apply ophthalmic lubricant. Tape eyelids shut horizontally. Ensure tongue is inside patient's mouth. A small soft bite block may help. Assess tongue for injury.

TORSO

- Place EKG leads on back while proning.
- Apply prophylactic foam dressings to pressure points.
- Ensure central lines, arterial lines and cannulas are secured (e.g., sutured).
- Empty ileostomy/colostomy pouches and pad around stoma site.
- If receiving enteral feedings, turn off feeding 1 hour before prone position.
- turn. Resume once in prone position as ordered.
- Secure all tubes and devices away from skin; protect surrounding skin with prophylactic dressings and bridge areas with positioning devices.
- Create channels for tubes with positioning aids. Ensure that there are no unsecured devices under the torso.

LEGS

- Apply prophylactic foam dressings to pressure points (e.g., patella and pretibial areas).
- Remove securement devices and align
- urinary catheter/fecal management device toward foot of bed.
- Ensure that there are no unsecured devices under legs. Offload feet.

BREASTS & GENITALIA

- are particularly sensitive tissues that should be offloaded and protected

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Patient Education from JAMA

Head and neck malpositioned
Arms down at sides
ET holder in place

Prone positioning is the technique of placing patients with breathing difficulties on their stomach to help them breathe better. Prone positioning is generally reserved for sedated patients who require a breathing machine, known as a ventilator, but it may be beneficial for awake patients with COVID-19.

Possible benefits of prone positioning include

- Reduced risk of ventilator-induced lung injury
- Less lung compression and more efficient gas exchange in the lungs
- Improved heart function and oxygen delivery to the body
- Better drainage of secretions produced in diseased lungs

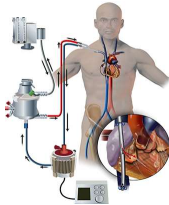
All patients placed in prone position should be monitored carefully for worsening respiratory status and symptoms.

<https://jamanetwork.com/journals/jama/fullarticle/2769872>

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ECMO use during COVID

- Venous-venous ECMO is a modified cardiopulmonary bypass circuit
 - Drains deoxygenated blood from the right atrium
 - Returns it to the femoral vein
 - Usual recovery from ARDS is 25%, with ECMO it rises to 60-70%
- Complications
 - Bleeding because anticoagulation is needed for ECMO
 - Hemolysis in septic patients
 - Peripheral ischemia
 - Risk of decannulation
- No formal recommendations for ECMO in COVID patients
 - Probably best used in younger patients with higher likelihood of survival




Paolone S. Extracorporeal Membrane Oxygenation (ECMO) for Lung injury in severe acute respiratory distress syndrome: review of the literature. *Clin Nurs Res* 2017, 26 (6), 747-762

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ECMO and COVID – Nursing Care for Skin

- Supine position with HOB up
 - Preventive dressings on sacrum
 - Microshifts
 - Partial turns with caution not to jar cannulas using the team of providers
 - Specialty bed
- Risk for limb ischemia
 - Boots if possible, otherwise dressings on heels
- Pressure injury under cannulas
 - Send dressings to OR when cannulas placed
- Protect occiput with positioner
 - No gel rings



ECMO: Nursing Care of adult patients on ECMO. *Crit Care Nurs Q*, 2018, 41(4), 394-398.

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Does COVID-19 Pathophysiology Lead to Unavoidable Pressure Injury?

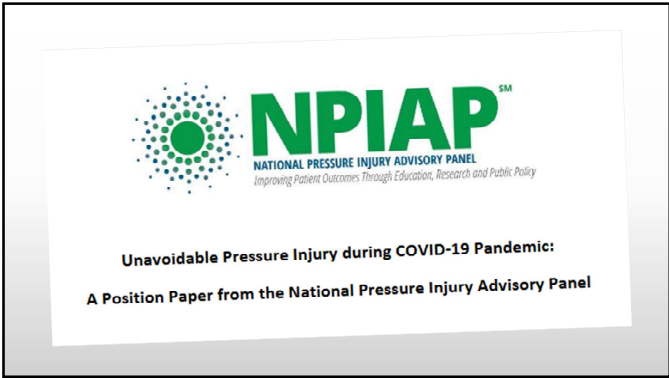
- Unavoidable pressure injury is one that occurs when the patient’s risk for PI has been appropriately addressed with interventions that have been provided and documented
 - Accelerated clotting leads to tissue that may not be able to tolerate reasonable pressure from a usual ICU bed
 - Marked dyspnea and impaired ventilation requires the patient sit up erect to breathe in positions that they cannot be easily turned to their sides

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What is the Standard of Care for COVID patients?

- Standard of care is defined as what a similar trained provider would do for a similar patient in the similar circumstances
 - It is “reasonable care” --- not excellent care
- So, when hospitals are in crisis or surge mode, with repurposing of staff and units....what is reasonable care?

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Pressure Injury VS COVID-19 Skin Change?

- Consider the position of the patient and location of the wound
 - If sitting in high-Fowler's, pressure/shear injury will be on lower buttocks
 - Deep tissue pressure injury will be delayed in presentation
 - Patient may be prone when wounds appear
 - Examine time frame 48 hours earlier
 - COVID-19 skin lesions due to clotting will appear ischemic and blister like DTPI, but the pressure component may be missing

The image block contains three photographs. The top left shows a pressure map of a buttock with a red area indicating high pressure. The top right shows a photograph of a pressure injury on a buttock. The bottom right shows a photograph of a COVID-19 skin lesion on a buttock, which appears ischemic and blister-like.

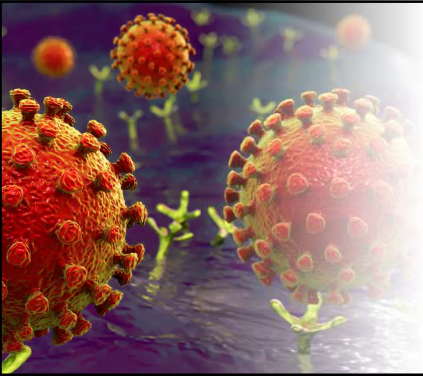
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Treatment of Pressure Injury

- Limited data to date
- Wounds should be managed conservatively
 - Conservative debridement
 - Nutritional support
 - Pressure offloading
 - Position side to side only
 - Place on upgraded mattress
 - Offload the heels
 - Move medical devices

The image block contains two photographs of pressure injuries on buttocks. The top photograph is labeled "1-12" and shows a large, deep, and bloody wound. The bottom photograph is labeled "2-26" and shows a similar wound, but with a more extensive area of necrosis and discoloration.

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COVID-19 leads to skin ischemia and treatments for COVID increase risk for Pressure Injury

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