Prone Position & Skin/Tissue damage Prevention
Prone Position & Skin Protection Education

Prevention of skin/tissue damage of the critically ill patient in the prone position
Disclaimer

• The information within this presentation is based on evidence from scientific literature and validation by international experts.

• This presentation reflects generalised information with the focus on the prevention of skin/tissue damage of the prone ventilated patient.

Skin Integrity Research Group
Ghent University, Belgium
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Learning objectives

• Understanding what **prone positioning** is
• Understanding why prone positioning is **effective**
• **Indications** and **contra-indications** for prone ventilation
• **Complications** of prone positioning
• Types of **skin/tissue damage**
• Key elements regarding **how to prone a patient**
• **Recommendations** to prevent skin/tissue damage for the patient in the prone position
Prone Position

Physiology, Indications and Contra-indications
What is prone position?

- The position of the body lying face down opposed to the supine position
What is prone position?

**Prone ventilation** refers to the delivery of monitored mechanical ventilation with the patient lying in the prone position.


Credit source: Cristian Cáceres Posta Central, Santiago de Chile
Prone position

• Prone Position (PP) ventilation is an effective therapy for patients with moderate to severe acute respiratory distress syndrome (ARDS)

• ARDS is a life-threatening inflammatory lung injury characterized by severe hypoxemia.

• PP improves gas exchange/oxygenation and survival.¹,²

Prone position

In the supine position, the lungs are compressed by the heart and abdominal organs.

In PP there is less lung compression and therefore more efficient gas exchange.

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

Prone position

• **Improved lung function** in PP,
• Less support from the ventilator is needed to achieve adequate oxygen levels

= Reduced risk of **ventilator-induced lung injury**
Prone position

• Improved **heart function** resulting in improved **oxygen delivery** to the body

• Better **drainage of secretions** in PP due to gravity

https://jamanetwork.com/journals/jama/fullarticle/2769872
Indications for prone positioning

- **Early prone positioning** when adequate oxygenation cannot be reached

- **Moderate to severe ARDS:**
  - PaO$_2$/FiO$_2$ ratio <150mmHG and
  - FiO$_2$ ≥ 0.6 and
  - positive end expiratory pressure [PEEP] ≥5 cm H$_2$O

PaO$_2$/FiO$_2$ Ratio of partial pressure of arterial oxygen to fraction of inspired oxygen

Indications for prone positioning

• Ideally **within 36 hours** of onset of ARDS and following 12-24 hours of supine ventilation allowing for treatment optimization.

• Prone ventilation for +/- 16 hours (Doctor’s orders)

[Link to UptoDate article](https://www.uptodate.com/contents/prone-ventilation-for-adult-patients-with-acute-respiratory-distress-syndrome/print)
Contra-indications

**Absolute**: Spinal instability

**Relative**:
- Open chest post cardiac surgery/trauma
- <24 hours after cardiac surgery
- Central cannulation for Veno-Arterial ECMO (extra-corporeal membrane oxygenation or BiVAD support (Biventricular Assist Device)
- Multiple Trauma e.g., Pelvic or Chest fractures, Pelvic fixation device


Contra-indications

- Severe facial fractures
- Head injury/Raised intracranial pressure
- Frequent seizures
- Raised intra-ocular pressure
- Recent tracheostomy
Adverse events

Complications associated with prone positioning
## Complications associated with prone positioning

<table>
<thead>
<tr>
<th>Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airway obstruction</td>
</tr>
<tr>
<td>Pressure ulcers/injuries</td>
</tr>
<tr>
<td>Endotracheal tube dislodgement</td>
</tr>
<tr>
<td>Nerve compression (e.g., brachial plexus injury)</td>
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<tr>
<td>Facial oedema</td>
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<tr>
<td>Dislodgement of vascular catheters</td>
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<tr>
<td>Retinal damage e.g., corneal injuries</td>
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<tr>
<td>Brady- tachy- arrhythmias (Bradycardia, Tachycardia)</td>
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Adverse events

Airway obstruction and pressure ulcers (PUs) are the most prevalent³

- Seven RCTs (n=2119)⁴
- Pressure ulcers are the most frequently observed adverse event at 34% of all complications
- (OR: 2.10, 95% CI: 1.55-3.09; p<0.0001; I² 0%)

Prone position poses a higher risk for the development of PUs compared to the supine position (RR 1.22, 95% CI 1.06-1.41, I² 0%).

Adverse events

Patton and colleagues (2021)
Meta-review of ten systematic reviews

Results:

Cumulative incidence of Pressure Ulcers/Injuries (PU/PIs) in 15,979 adult patients
= 25.7% to 48.5%

Example

Patient who developed **pressure ulcers** on his chest during 16 hours of prone positioning.

Credit source: V. Hanssens
Types of Skin/Tissue damage

Prone Position
Types of skin/tissue damage

- **Pressure ulcers/injuries** (PU/Is)
- **Medical device-related pressure injuries** (MDRPIs)

**Example:**
Patient developed MDRPIs - The endotracheal tube caused tissue damage (upper lip) whilst in the prone position.
Types of skin/tissue damage

- Pressure ulcers/injuries (PU/Is)
- Medical device-related pressure injuries (MDRPI)

Please refer to the below resources

Resources:

[https://npiap.com/page/FreeMaterials](https://npiap.com/page/FreeMaterials) (to review PU/I categories, stages)
Types of skin/tissue damage

- Pressure ulcers/injuries (PU/Is)
- Medical device-related pressure injuries (MDRPI)
- Skin Tears
Types of skin/tissue damage

- Pressure ulcers/injuries (PU/Is)
- Medical device-related pressure injuries (MDRPI)
- Skin Tears (patient handling & adhesives)

Resources:
International Skin Tear Advisory Panel (ISTAP)
https://www.skintears.org/
(classification of skin tears and best practice recommendations)
Types of skin/tissue damage

- Pressure ulcers/injuries (PU/Is)
- Medical device-related pressure injuries (MDRPI)
- Skin Tears
- Medical adhesive-related skin injuries (MARSI)

*Credit source: A Fourie*

**e.g., skin stripping** from either

a) repeated dressing/tape removal or b) adhesive bond to skin being too strong/aggressive

*Skin visible on dressing*
Types of skin/tissue damage

- Pressure ulcers/injuries (PU/Is)
- Medical device-related pressure injuries (MDRPI)
- Skin Tears
- **Medical adhesive-related skin injuries (MARI)**

**Resources:**
Wounds UK. Medical Adhesive-Related Skin Injuries (MARI): Made Easy. Wounds UK.
Types of skin/tissue damage

- Pressure ulcers/injuries (PU/Is)
- Medical device-related pressure injuries (MDRPI)
- Skin Tears
- Medical adhesive-related skin injuries (MARSI)
- Moisture-associated skin damage (MASD)

One type of MASD is Incontinence-associated Dermatitis (IAD)
Types of skin/tissue damage

- **Moisture-associated skin damage (MASD)**
  
  - Superficial skin damage
  - **Prolonged exposure to excess moisture**
    - Moisture-associated skin damage (MASD) is the umbrella term for a range of conditions where exposure to excessive bodily fluids results in pain, burning, irritation and possible skin breakdown

Types of skin/tissue damage

- **Moisture-associated skin damage (MASD)**
  - Incontinence-associated dermatitis (IAD)
  - Peri-stomal MASD
  - Peri-wound MASD
  - Intertriginous MASD (in-between the skin folds, sweating & friction)


https://www.skintears.org/ Best practice recommendations: MASD
Skin/Tissue damage - PP

- **Pressure ulcers (PUs)** across all categories/stages
  - Medical devices and weight bearing areas

Stage 2 PUs on knees during prone positioning (PP)

Unstageable PUs on chest during 16 hrs. of PP.

Credit source: V. Hanssens
Skin/Tissue damage - PP

- **Skin tears** [patient handling, adhesives]
- **Moisture-associated skin damage** (MASD)
  - **Incontinence-associated dermatitis** (IAD)

MASD risk →
increased secretions during PP – mouth, cheeks, neck, chest

IAD in prone position might only be noticed when patient is back in supine position. Different affected contact areas. Protect prophylactically

Credit source: Carlos Segovia Mutual de Seguridad - Burns patient (alternating prone, supine positioning)

Credit source: A. Fourie, SA
Risk areas for skin/tissue damage

Prone Position
Risk areas for skin/tissue damage

• Vulnerable pressure points

• Medical device-related PUs

• Moisture-associated skin damage
  • Including incontinence-associated dermatitis (IAD)

• Skin tears (adhesives or mechanical forces during positioning/repositioning)
Recommendations

Prevention of skin/tissue damage in the prone position
1. Prepare the Team
2. Prepare the Patient
3. Reposition
1 PREPARE THE TEAM
**Prepare the Team**

- Receive Doctor’s order to prone the patient
- Notify the multidisciplinary team who are skilled in the prone manoeuvre
- Ensure an adequate number of team members are available (5-7)
- >5 members if ECMO or chest tubes or morbidly obese patient
- Assign a team leader
- Communicate the roles and responsibilities within the team
- One dedicated specialist for airway management
- No contra-indications for PP
- Procedure explained to family/next of kin

**Prepare the Patient**

**Reposition**

**PRONE Kits:**

- Recommended to have pre-packed kits/packs with all the devices needed for PP readily available
- Include the checklist
Prone Team

- Trained & experienced multidisciplinary members (operating room, physiotherapy...)
- Assist with staff safety
- Assist with the prevention of adverse events
- Repositioning - prone manoeuvre
Specialised equipment

- Apply specialised equipment/devices for pressure redistribution
- Applied to own health care setting, availability, budget and staff safety.

3 Pressure Redistribution

- Off-load with fluidised positioners or air inflatable devices.
- Gel pads and positioners.
- Use soft cornered wedges to elevate feet. Check that toes do not touch any surface.
- Pillows: 3-4 dependent on patient size.
2 PREPARE THE PATIENT
• Patient **hygiene** and **skin assessment**

• Moisturise the skin (focusing on arms and legs) for prevention of **skin tears**

• Faecal incontinence: prevent **incontinence-associated dermatitis (IAD)**
  - Alcohol-free liquid barrier
  - Frequent diarrhoea:
    - Consult with dietician
    - Consider a faecal management system
    - Advanced skin protectant like a cyanoacrylate barrier

Prevent MASD

- Apply an alcohol-free liquid barrier
  - Underneath all adhesives (tape and non-silicone adhesive dressings)
  - All areas exposed to secretions and moisture (mouth, cheeks, skin folds, stoma sites, perineal area)
  - Apply barrier preventatively – not only when the skin is already red/irritated/inflamed.

Absorbent pad can be applied underneath patient’s head or apply alginates/hydrofibres (dressings) to absorb extra secretions.
Secure naso-gastric tube

Secure the endotracheal tube (ETT)
PREPARE THE TEAM

PREPARE THE PATIENT

REPOSITION

• Skin clean and dry

• Remove excess facial hair with surgical clippers, not shaving with a razor (micro-cuts to the skin)

• Protect skin against medical-adhesive-related skin injuries (MARSI) with a liquid barrier

• Select the right type of tape

• Special attention – prevention of medical device-related pressure injuries (MDR-PIs)
Different devices for ETT securement

- **Endotracheal ties or padded twill**
- Recommended to place a thin foam dressing underneath the ties to prevent MDR-PIs
- **Adhesive tape** indicated for critical tube securement (strong adhesion) i.e., cloth/material tape with acrylate adhesive
- **Rotate tubes** 2-3 hourly
Prevent MDR-PIs

Device should not touch the lips

Credit source: Carlos Segovia Mutual de Seguridad

Credit source: PRONEtect Education
Commercial ETT holders - plastic

- Not recommended for prone ventilated patients
- Could cause **MDR-PIs** when lying face-down
Eye care

- Risk for corneal abrasions (eye injuries) in the prone position
- Lubricate the eyes
- Tape eyes closed (or use anaesthetic eye shields)
  - Eye lashes forward (not pointing inwards towards the eye)
  - Horizontally over the eyelids
  - Soft paper-based or silicone tape
Protect high-risk areas

- **Apply** multilayered silicone-adhesive foam dressings over bony prominences and vulnerable skin areas.*
  - Pad areas around drains and stoma sites

- **Position** the penis between the legs, the Foley catheter towards the feet, and ensure catheter is not pressing against the inner thighs.

- **Moisturise** the skin – prevent skin tears

* Extensively trialed in supine position. Biomechanical studies in PP, not yet in clinical pragmatic trials on PP high risk areas

3 REPOSITION
**PRONE POSITION/REPOSITION PROTOCOL:**

**Skin Protection Strategies**

**Supine-to-Prone Manoeuvre**

*(Video # 00a)*

Team: 5-7 People – the manoeuvre takes approximately 10-15 minutes when all preparations have been done.

*Nb! Emergency equipment should be on hand in case of accidental extubation*

- One specialist (e.g., respiratory therapist (RT), medical doctor...), should be dedicated to airway management standing at the head of the bed. Two members to stand on each side of the patient
- Assigned team leader will give the instructions to the rest of the team and communicate the direction the patient will be rotated; usually towards the ventilator
- It is preferred to have one of the prone team members to be hands-off to coordinate the procedure and monitor vital signs
- Note vital data right before prone positioning
3 REPOSITION
SWIMMER’S POSITION
PRONE POSITION/REPOSITION PROTOCOL:
Skin Protection Strategies

Swimmer’s position (Video #08)

To avoid brachial plexus injury:

1. Maintain straight spine alignment and avoid excessive arm rotation
2. Raise the arm on the same side as the head is facing; ensure that the ‘up arm’ does not extend beyond 70 degrees with elbow extension or external rotation of the shoulder beyond 60 degrees
3. Avoid over-extension of the shoulders which could place abnormal pressure on the brachial plexus
   a. Place support underneath the patient’s chest for the shoulders to ‘fall forward’
4. Other arm is placed next to/alongside the body
5. Ensure that the neck is not hyperextended
6. Check the ETT and NGT to ensure there is no pressure on the mouth/lips or nares from these devices
7. Ensure ears are not bent over or compressed
8. If possible, bend the knee (on the side the head is facing) slightly upwards for spinal alignment
Patient positioning

Swimmer’s position

- Patient in swimming position, **head facing the arm** in abduction
- Arm not positioned in abduction beyond 70° to avoid **brachial plexus injury**
- Chest support to allow shoulders to ‘fall forward’ to **avoid over extension of shoulders**
- Reposition head **2-4 hourly** or as clinically indicated, support head in neutral position
- Red circles: area where support is needed
Patient positioning

Further reading:

Bed position

- Reverse Trendelenburg position to decrease facial oedema
- Usually, 10-25 degrees
- If the degree of bed tilt is too high, it could cause shear and frictional forces
- Tilt the whole bed and not only the head of the bed for normal spine alignment

- Duration of prone session:
- Approximately 16 hours; according to Doctor’s orders.
PRONEtect Practice Guidance

- More information
- Based on evidence-based scientific literature
- Reviewed and approved by international expert panel


Integral part of the PRONEtect project, providing expert opinions regarding academic and clinical needs based on evidence-based literature and experience.

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