

Tissue Distortion: Reducing the Risk of Injury in the Surgical Population



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Disclosures

- Speaker for Stryker's Sage business

Objectives

- Illustrate the pathophysiology and prevalence of skin, nerve and tissue injuries in the operating room
- Describe the commonly used surgical positions, associated pressure points, and the risk factors for positioning injuries.
- Discuss evidence-based practices, competencies, and technology for reducing risk of tissue injury to surgical patients

History of Perioperative Pressure Injury (PPI)^{1,2}

- “Surgery is one of the few times a normal, healthy individual is placed at risk for pressure sores”

- Gendron 1980



Operating Room Table Circa 1905

Photo used with permission Marie Brown-Etris RN, CWON, CCHP

Virginia Henderson's Nursing Needs Theory ³

- Protect the Integument
- Avoid dangers
- Move and maintain desirable postures
- Maintain body temperature
- Adequate nutrition

The First Lady of Nursing

AORN: Goals of Patient Positioning 4-6

Competency: Staff completes education and competency verification related to positioning.

Outcome: The patient is free from signs and symptoms of injury related to positioning.

Free from Harm

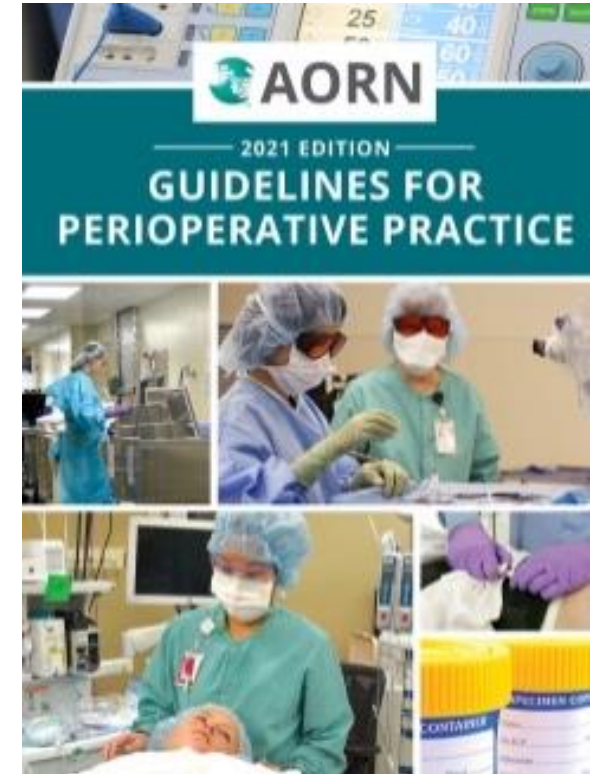


Photo courtesy of AORN Guidelines 2021 Edition

Hospital Acquired Pressure Injury (HAPI)⁷⁻⁸



2.5 M

HAPI developed in
the US Acute Care⁷

\$26.8 B

US Cost of HAPI⁷

45% of HAPI

Pressure ulcers attributable
to the OR⁸

Perioperative Pressure Injury (PPI) ^{8, 9}

A PPI is any pressure-related tissue injury that presents as (non-blanchable erythema, purple discoloration or blistering) within 48-72 hours postoperatively and is associated with the surgical position or medical device, and up to 7 days for deep tissue injury.



CABG 48 hrs post op

Perioperative Pressure Injury Prevalence ⁸⁻¹²

Overall

4-45%, 12%-66%

Surgery >3 hrs 8.5%



Occiput 4%

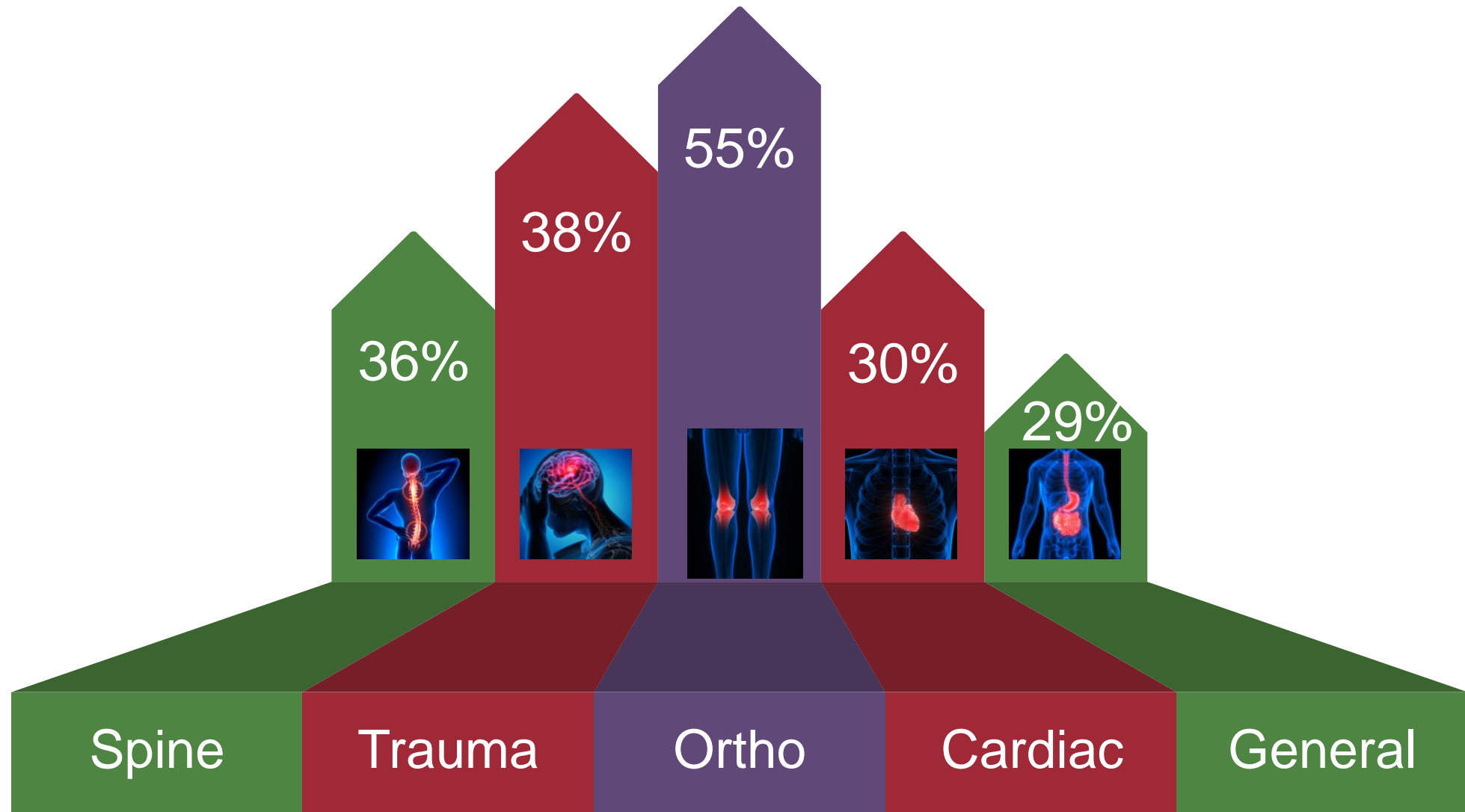
Elbow 5%

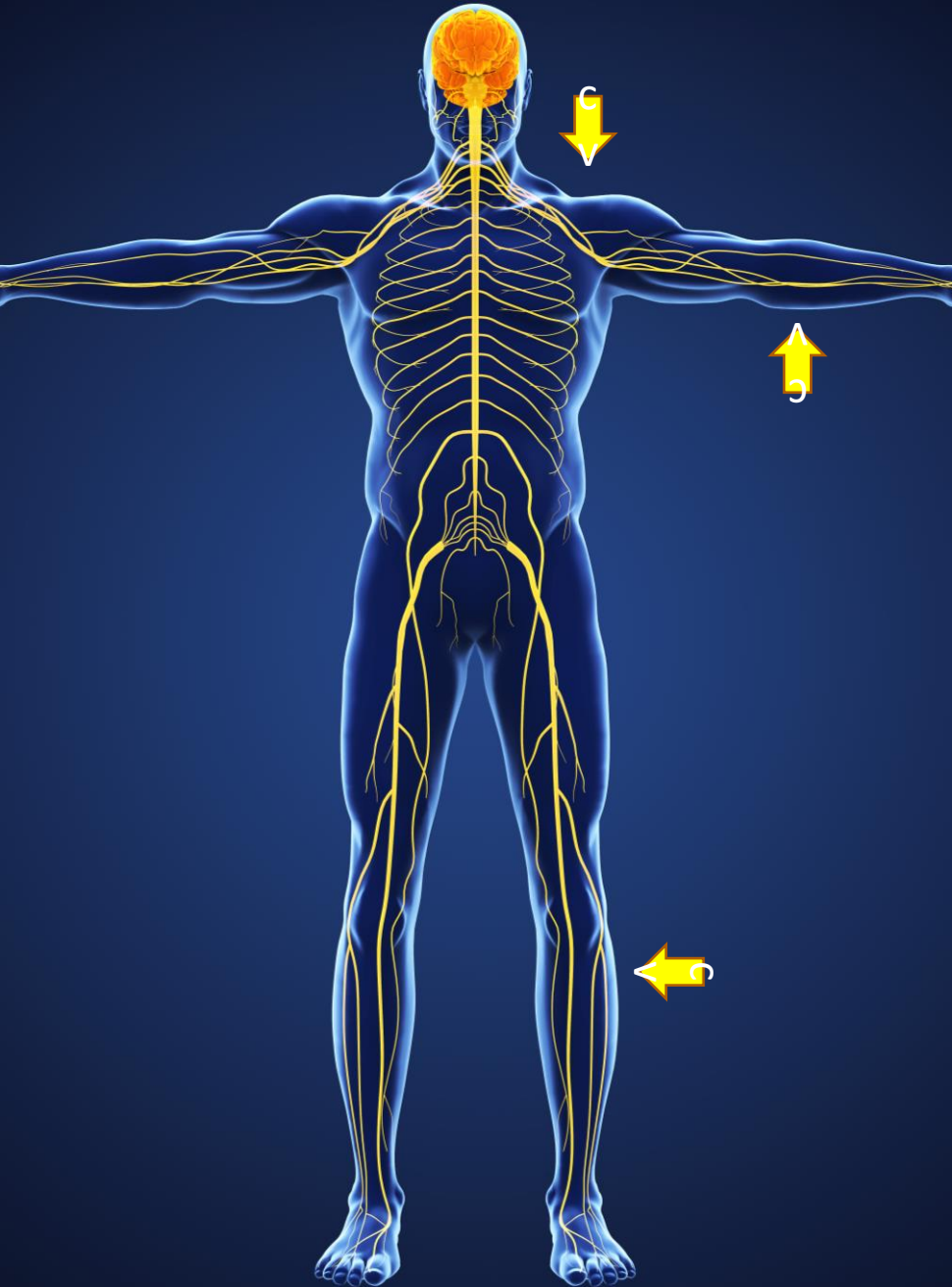
Sacral 22% - 41%

Buttocks 11% - 47%

Heels 14% - 52%

PI rates per Surgery Specialty ¹¹





Peripheral Nerve injuries^{10,13,14}

- Incidence and Contributing factors
- Brachial Plexus
- Ulnar Nerve
- Peroneal & Tibial nerve
- Malpractice
 - 12% of general anesthesia malpractice claims
- High Risk Factors
 - Prone position – visual loss
 - Cardiac, neurosurgery, and orthopedic.
 - Surgery over 3.5 hrs

What is Tissue Distortion?

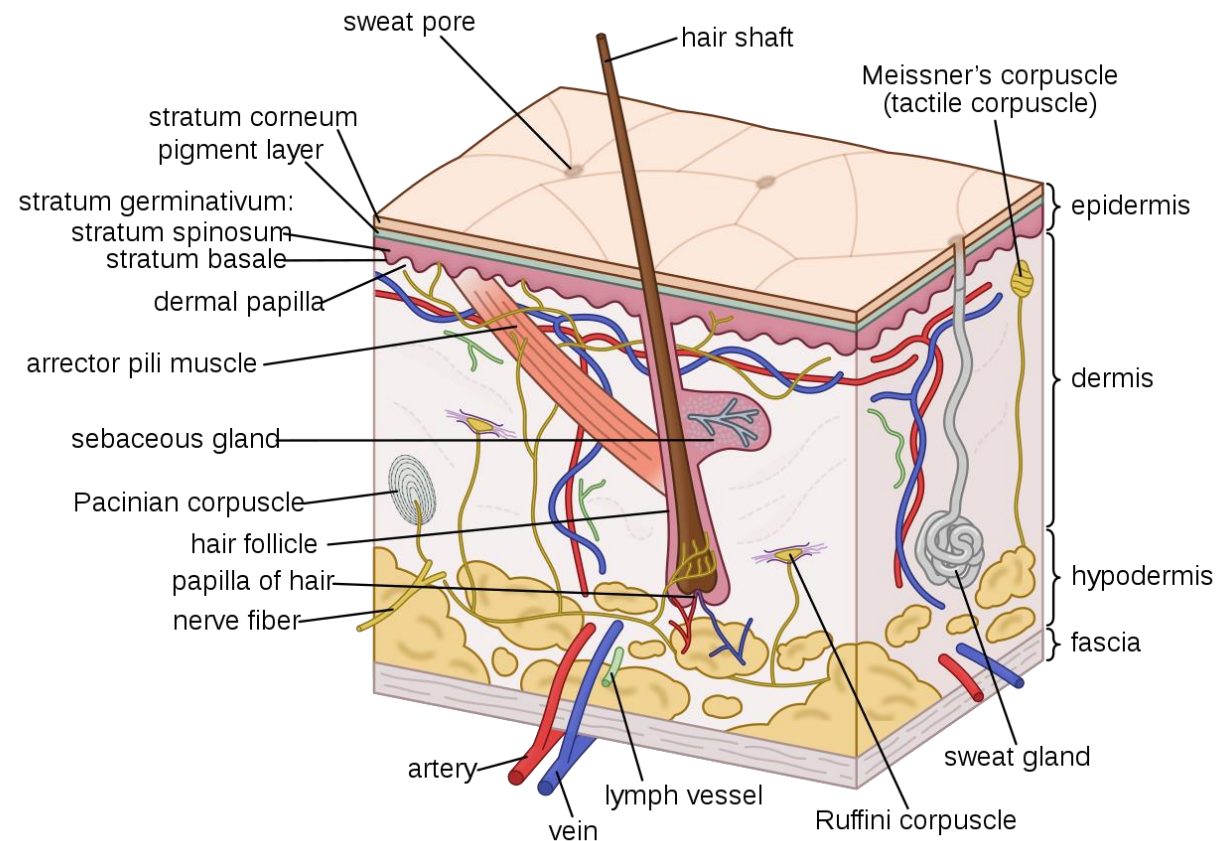
Skin and Tissue ¹⁵

Skin roles and function

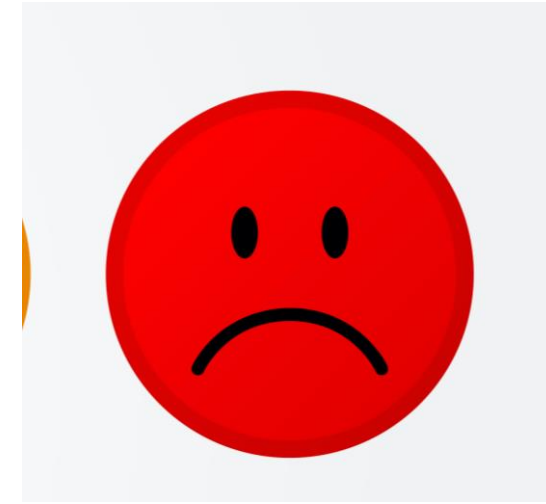
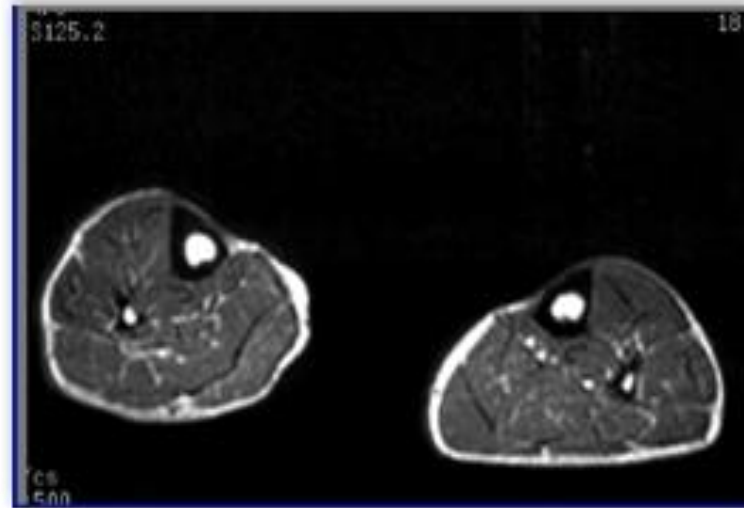
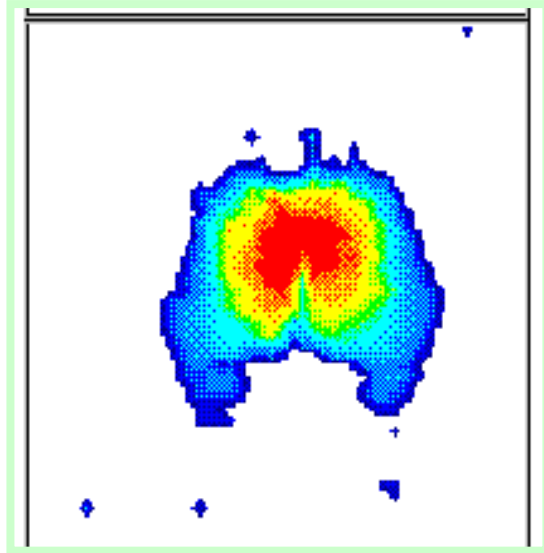
- Protection
- Immunity
- Temperature regulation
- Water barrier
- Sensation

Skin layers

- Epidermis
- Dermis
- Adipose tissue
- Muscle
- Bone



Etiology of Pressure Injury 10,15-16



**Bony
Prominence**

**Sustained
Pressure**

**Tissue
Distortion**

**Cell
Death**

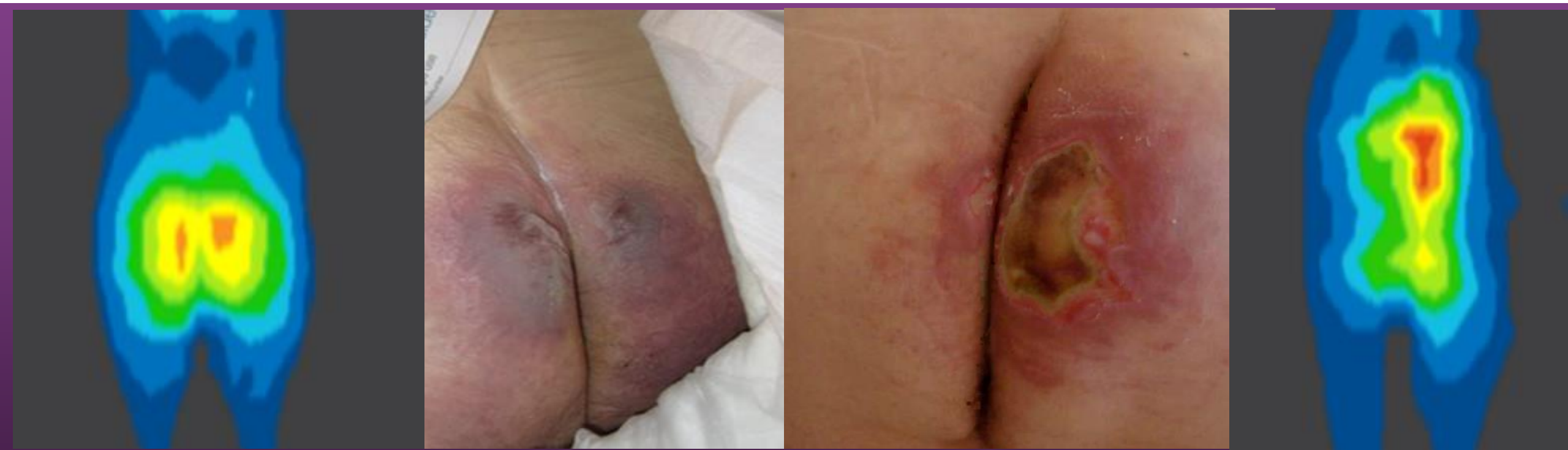
**Pressure
Injury**

Anatomage Images



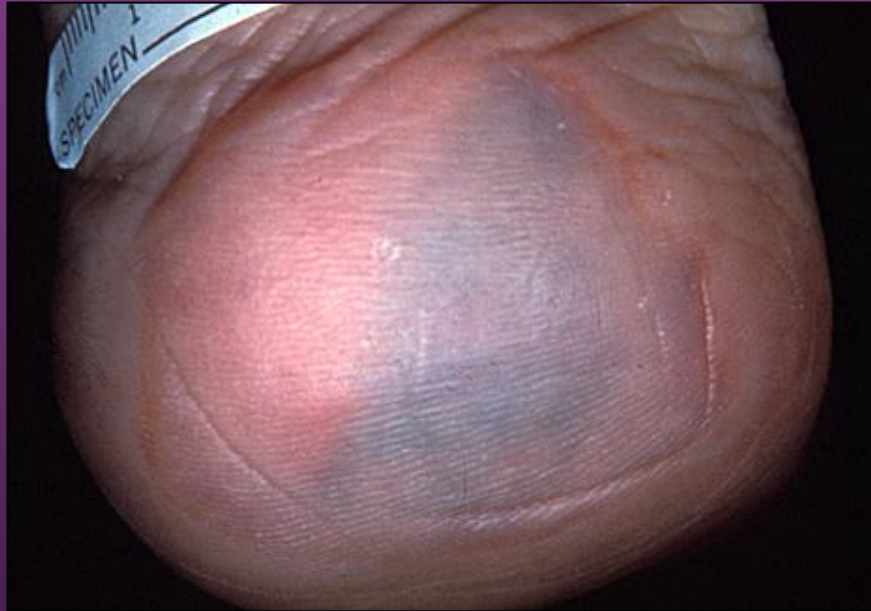
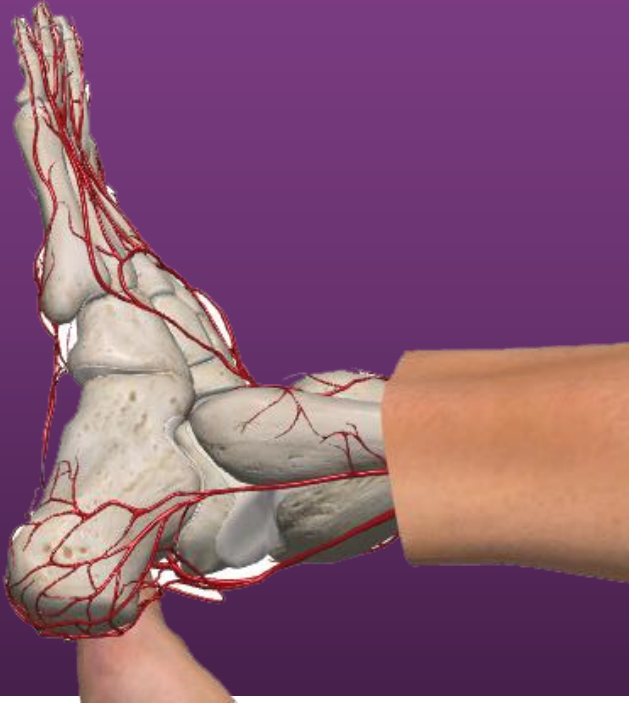
Images courtesy of the University of Tennessee Health Science Center

Pressure and Distortion of Tissues^{15.16}



Photos used with permission by Joyce M. Black PhD RN FAAN

Heel Pressure Injury¹⁵



Photos courtesy of www.scotttriggers.com and Marie Brown-Etris

Alopecia ⁴

- Alopecia can occur after 4 hrs of prolonged pressure
- Occiput most common site in pediatrics
- Reposition the head every 30 min



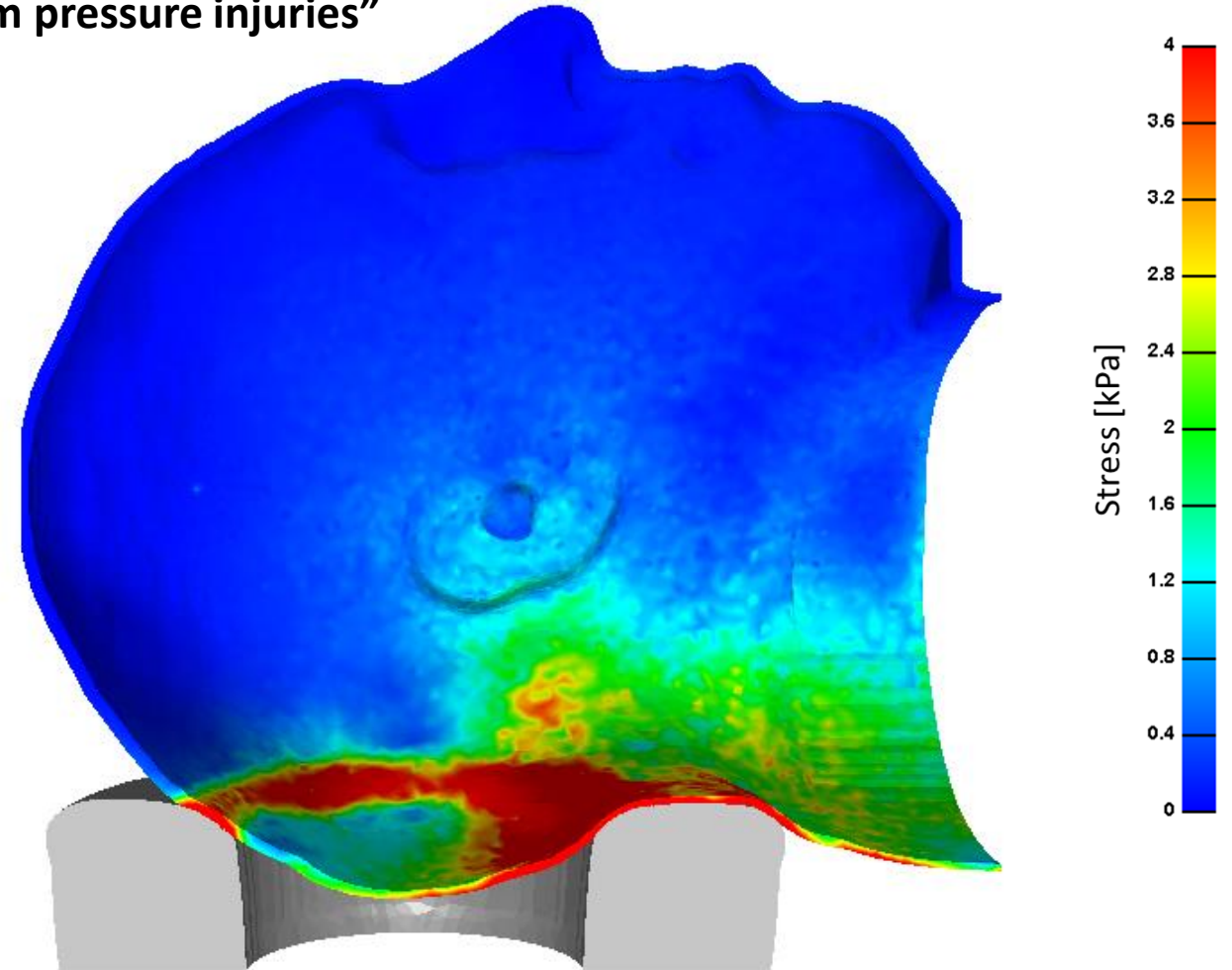
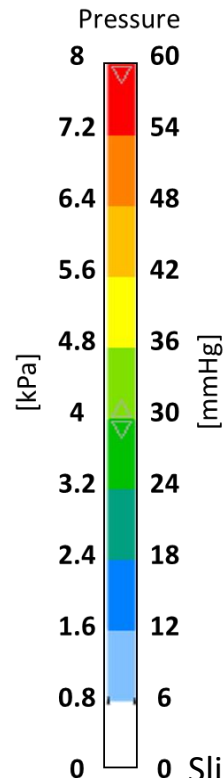
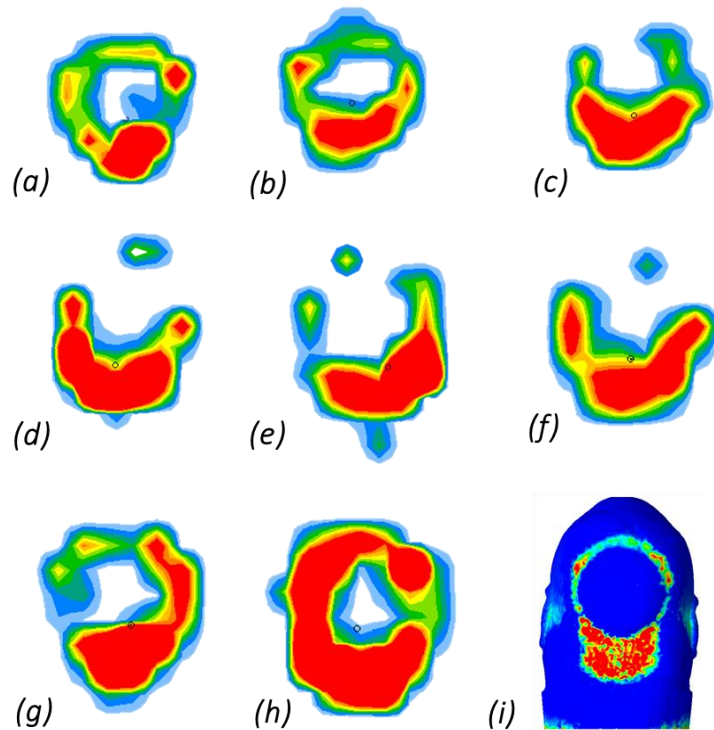
New understanding can lead to better preventive technologies ¹⁷



The donut-shaped gel head support: An example of a **wrong** solution

“Offload pressure from occipital protrusion to protect the patient from pressure injuries”

Donut head-positioners



Perioperative Plan of Care ⁴⁻⁶



Pre-op



Intra-op



Post-op

Risk Assessment for Pressure Injury

4, 9-10, 18-21

Braden
Scale

Munro
Scale

Scott
Triggers

PRAMS

Scott Triggers 22-27

- Validation studies
- Martinez et al. 2012, N=21,377 – PI reduction. P=0.0004
- Bollinger, Postlewaite et al. 2017, N=675 - ST > Braden,
- Park et al. 2019, N=400 Higher Sensitivity ST > Braden
- Emerson 2020, N=11,241 – PI reduction. P=0.015



Scott Triggers	Does it meet these qualifications?	If YES, please place check here
Age	Age 62 or older	
Serum Albumin _____g/L or BMI	Albumin level <3.5 g/L or BMI <19 or >40	
ASA Score (Circle) 1 2 3 4 5 6	ASA score 3 or greater	
Estimated surgery time Hours/minutes	Surgery time over 3 hours or 180 minutes	
Two or more YESSES =	HIGH RISK SURGICAL PATIENT	

Artificial Intelligence & Bundles 24,25

 Scott Triggers

Scott Triggers Risk Assessment

Age 62 or Older (Current Age: 69)	<input type="button" value="No"/>	<input checked="" type="button" value="Yes"/>
Albumin Level <3.5 g/L (Current Albumin Level: 3.2)	<input type="button" value="No"/>	<input checked="" type="button" value="Yes"/>
BMI <19 or >40 (Current BMI: 46.37)	<input type="button" value="No"/>	<input checked="" type="button" value="Yes"/>
ASA Score 3 or Greater (Current ASA: 4)	<input type="button" value="No"/>	<input checked="" type="button" value="Yes"/>
Surgery Time Over 3 Hours or 180 Minutes (Scheduled Surgery Time: 185 Minutes)	<input type="button" value="No"/>	<input checked="" type="button" value="Yes"/>

****Patient is at High Risk for Developing a Pressure Ulcer****

Choose Patient's Position

Supine

Lateral/Parkbench

Lithotomy

Please see positioning instructions in the sidebar report titled **JHH OR Scott Triggers Prone Position.**

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Patient Specific Risk Factors 4,8

- Type of Procedure
- Time on the table and immobility before surgery.
- Obesity
- Pregnant
- Disabilities
- Critically Ill, Spinal Cord Injury (SCI), Palliative Care
- Critical devices catheters and drainage tubes
- Vascular perfusion and effects of inotropes/vasopressors
- Anesthesia type and ASA score

Bariatric Patient Considerations 4,8,28-30

- Class 1,2,3 Obesity
- Extremely obese BMI $>40 \text{ kg/m}^2$
- Risk of respiratory and circulatory compromise
- Safer Practices:
 - Mattress rated to 1000 lbs.
 - Lateral air transfer device
 - Side bed attachments, sleds
 - Bariatric stirrups
 - Wider, longer safety straps
 - Foam, gel, air, fluid positioning aids



**Avoid Positioning
Hazards AORN**

Strategic Plan ³²

1. Quality Improvement RCA²
2. Assessment (Gap Analysis)
3. Staff Education & Competency
4. Evidence-based OR Skin Bundles
5. Risk Assessment & Skin Assessments
6. Universal Pressure Precautions
7. Positioning Competencies
8. Product Selection/standardization
9. Interprofessional collaboration



SCOTT PPIPP



Root Cause Analysis and Action (RCA²) 33,34



What happened?

Why did it happen?

How to prevent it from happening again?

OR Skin Bundle 4, 35-36

- Pre-op risk and skin assessment
- Safe patient handling
- Reduce, Relieve, or Redistribute Pressure
 - OR table pads
 - Positioning devices
 - Padding bony prominence
 - Offload heels
 - Prophylactic dressings
- Maintain normothermia
- Documentation



Skin Assessment

Skin Assessment



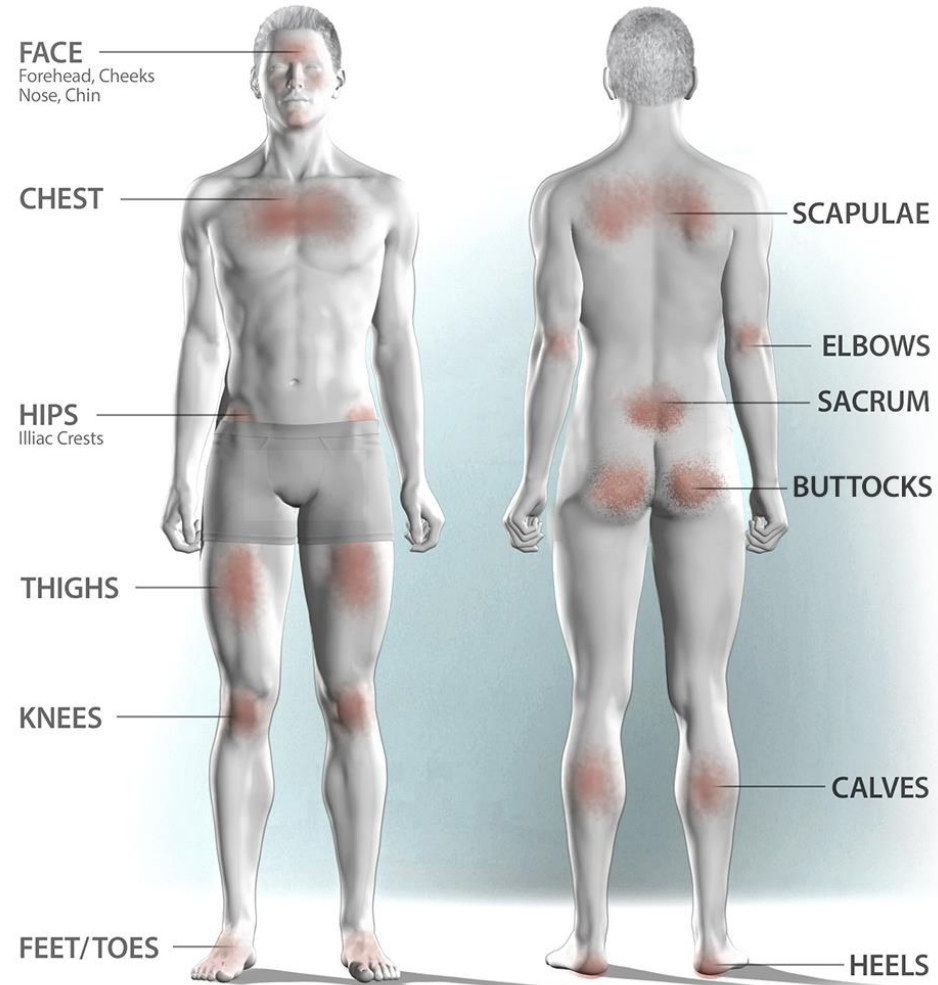
Timing

Skill

Accuracy

Documentation

High Risk Pressure Points 4,10,15,37



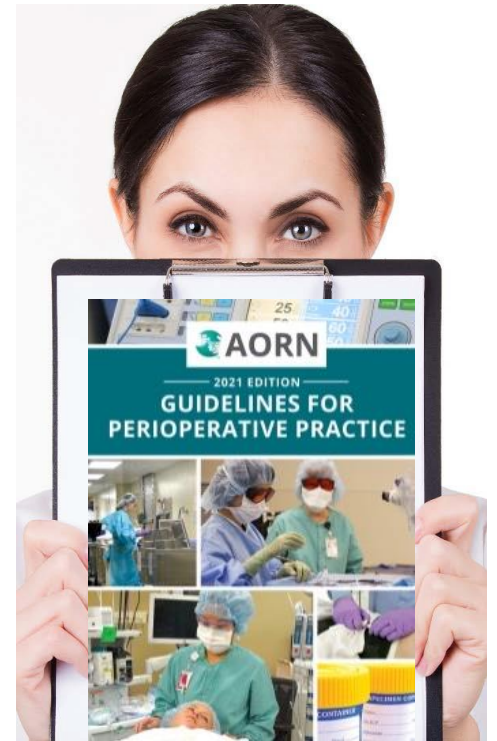
Safe Patient Handling

Nursing Impact 4,38



AORN SPH Recommendations “Supine” 4,38

- Weight < 157 lb.
 - Use lateral transfer device & 4 caregivers
- Weight > 157 lb.
 - Use mechanical lift with supine sling, mechanical lateral transfer device, or air- assisted lateral transfer device & 3 to 4 caregivers

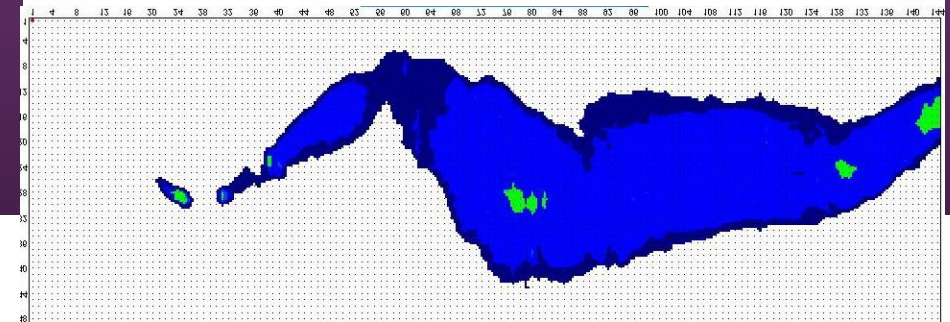
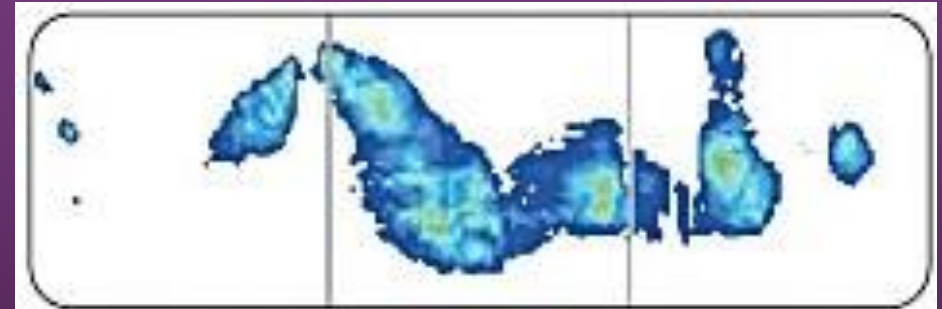
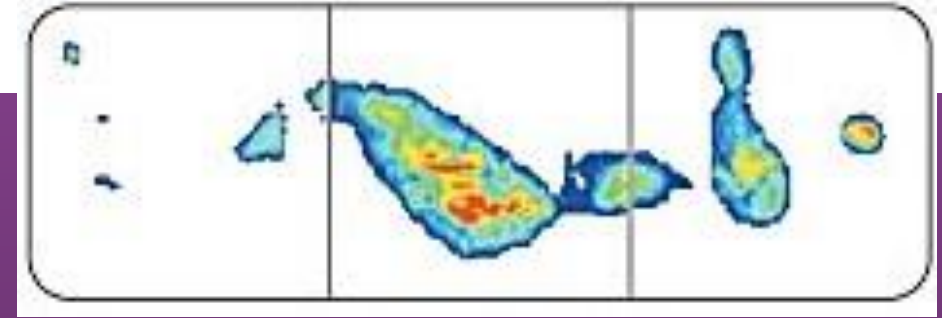


How many of our patients weigh >157 lbs.?

Pressure Redistribution Support Surfaces

OR Table Pads Check Specifications 4,10,15,30

- Therapeutic weight capacity
- Thickness 3-4 in
- Stability for positions
- Radiolucency
- Research, standardized testing



Immersion & Envelopment

Device Maintenance 6,39

ECRI “Healthcare facilities should regularly inspect mattresses and covers for signs of damage or contamination.”

AORN “Maintain inventory of positioning equipment, devices, and support surfaces to meet needs, and recognize need for preventive maintenance and repair at regular intervals.”



Surgical Positioning & Devices

- Injury reduction considerations



Common Surgical Positions 4, 10, 15, 37



SURGICAL POSITIONS



Supine Position



Trendelenburg Position



Reverse Trendelenburg Position



Fracture Table Position



Lithotomy Position



Prone Position



Jackknife Position



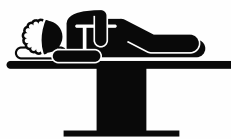
Fowler's Position



Knee-Chest Position



Kidney Position



Lateral Position



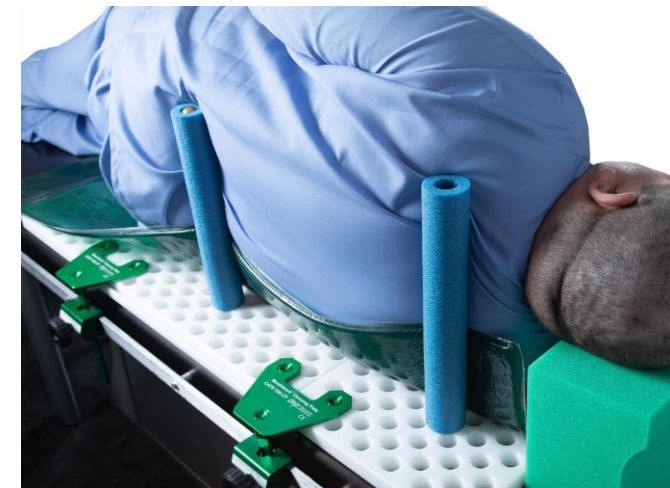
Wilson Frame Position



High Risk Medical Devices



- Anesthesia devices
- Face plates in prone position
- External fixators
- Urinary catheters & tubing
- Vacuum-packed positioning device
- Peg Boards
- Bookwalter
- Mayo stands on the toes
- Safety straps
- Compression stockings



Supine Position 4, 10, 15, 37



- Occiput
- Scapulae
- Arms
- Elbows
- Thoracic vertebrae
- Lumbar area
- Sacrum/coccyx
- Buttocks
- Heels



Prone Position 4, 10, 15, 37



- Forehead, eyes, ears, and chin
- Anterior shoulders
- Breast/chest (implants, ports)
- Lower costal margins
- Iliac crest
- Genitalia (7.7%)
- Knees
- Shins
- Dorsum of the feet
- Toes



Prone Position 4, 10, 15, 37



- Pressure injury
- Increased intraocular pressure
 - Blindness
- Increased intra-abdominal pressure
- Cardiovascular changes
- Venous air embolism
- Respiratory changes
- Injury to the caregiver

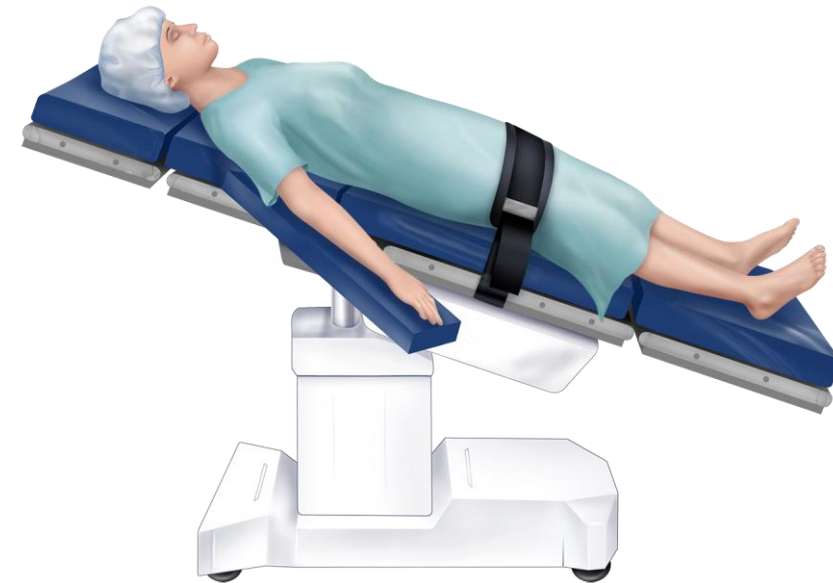
- Do not use Wilson Frame
- Face, chin and forehead highest risk



Trendelenburg and Reverse Trendelenburg Position 4, 10, 15, 37



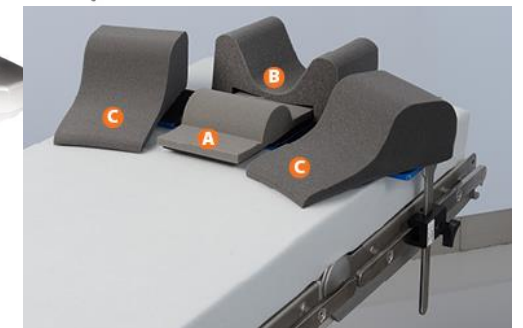
- Occiput
- Scapula
- Arms
- Elbows
- Vertebrae
- Lumbar
- Sacrum/coccyx
- Buttocks
- Heels



Risks of Trendelenburg Position (TP) 4, 6 17



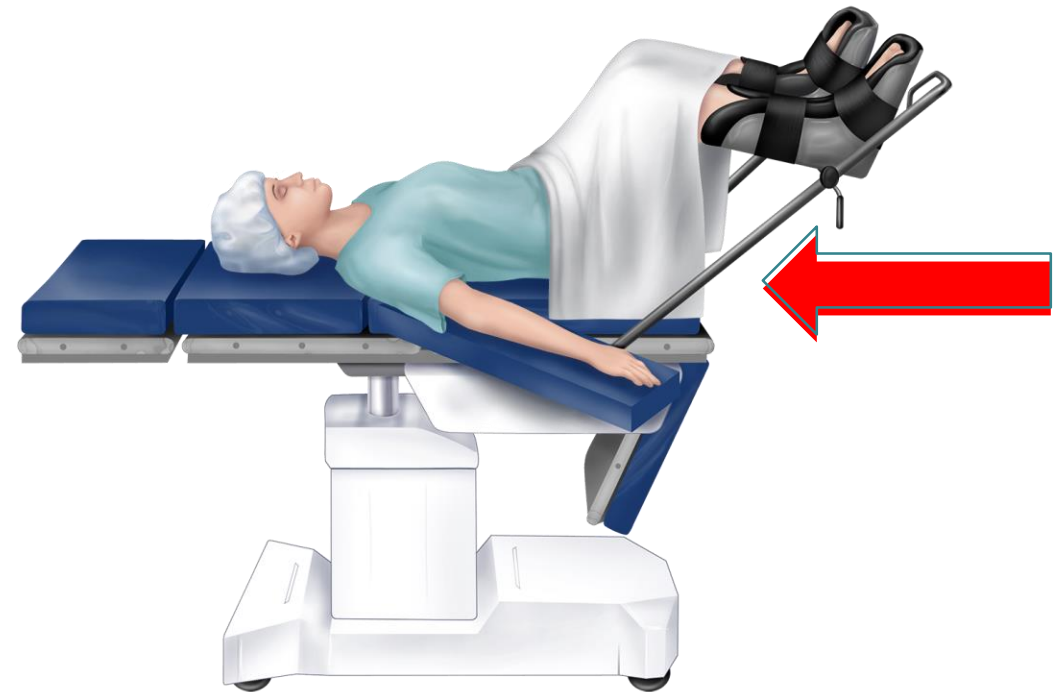
- Tuck arms at side
- Minimize degree of TP
- Implement measures to keep from sliding
- Do not use shoulder braces
- Do not use circumferential wrist restraints
- Shortest time possible
- Do not use in BMI >40 extremely obese
- Use padded foot board





Lithotomy Position 4, 6, 10, 15, 37

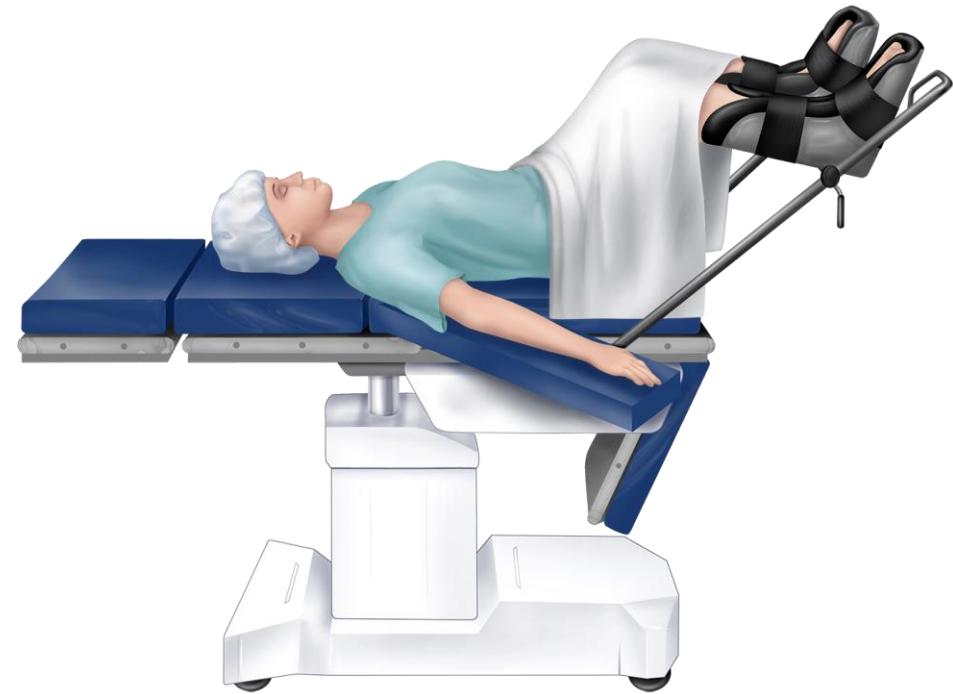
- Occiput
- Shoulders
- Scapulae
- Arms
- Elbows
- Thoracic vertebrae
- Lumbar area
- Sacrum/coccyx
- Buttocks
- Lateral aspect of the legs
- Heels





Lithotomy Position 4, 6, 10, 15, 37

- Fractures
- Nerve injuries
- Hip dislocation
- Muscle injuries
- Pressure injuries
- Diminished lung capacity



Lateral Position 4, 10, 15, 37



- Side of face and ear
- Shoulder
- Arms
- Dependent axilla
- Dependent hip/trochanter
- Legs
- Dependent knee
- Ankles
- Feet



Sitting Position Pressure Points 4, 6, 37



- Occiput
- Scapulae
- Elbows
- Thoracic vertebrae
- Lumbar area
- Ischial tuberosities
- Sacrum/coccyx
- Back of knees
- Heels





**Offload
Heels**

Heels and ankles are vulnerable in multiple positions^{46, 9}



**OR Heel Pressure Injury 52.9% and 52 %
Schoonhoven and Scott respectively**

Use Heel Off Loading Devices (HOLDs) 4,15

- “Offload the heel & distribute the weight of the leg along the calf without putting all the pressure on the achilles tendon.
- Hyperextension of knee can lead to popliteal vein compression and increase risk of DVT.”

Consider Prophylactic Dressings for Bony Prominences and Under Medical Devices ⁴



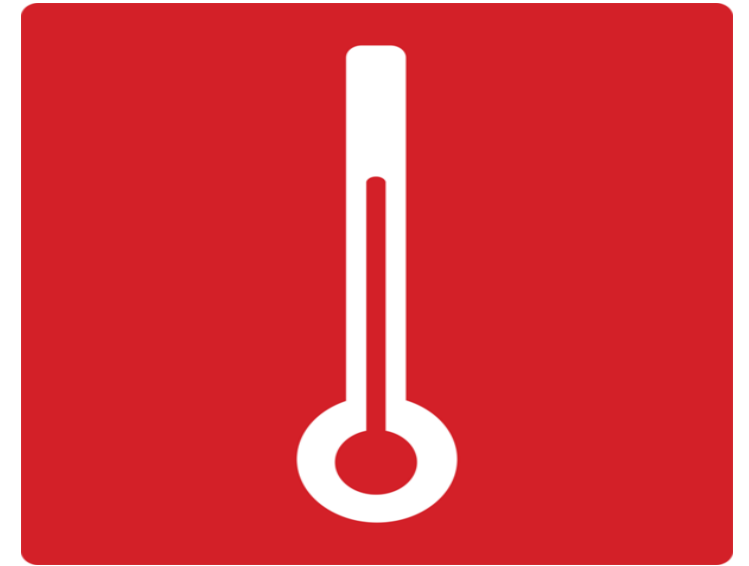
Correct Use of Devices



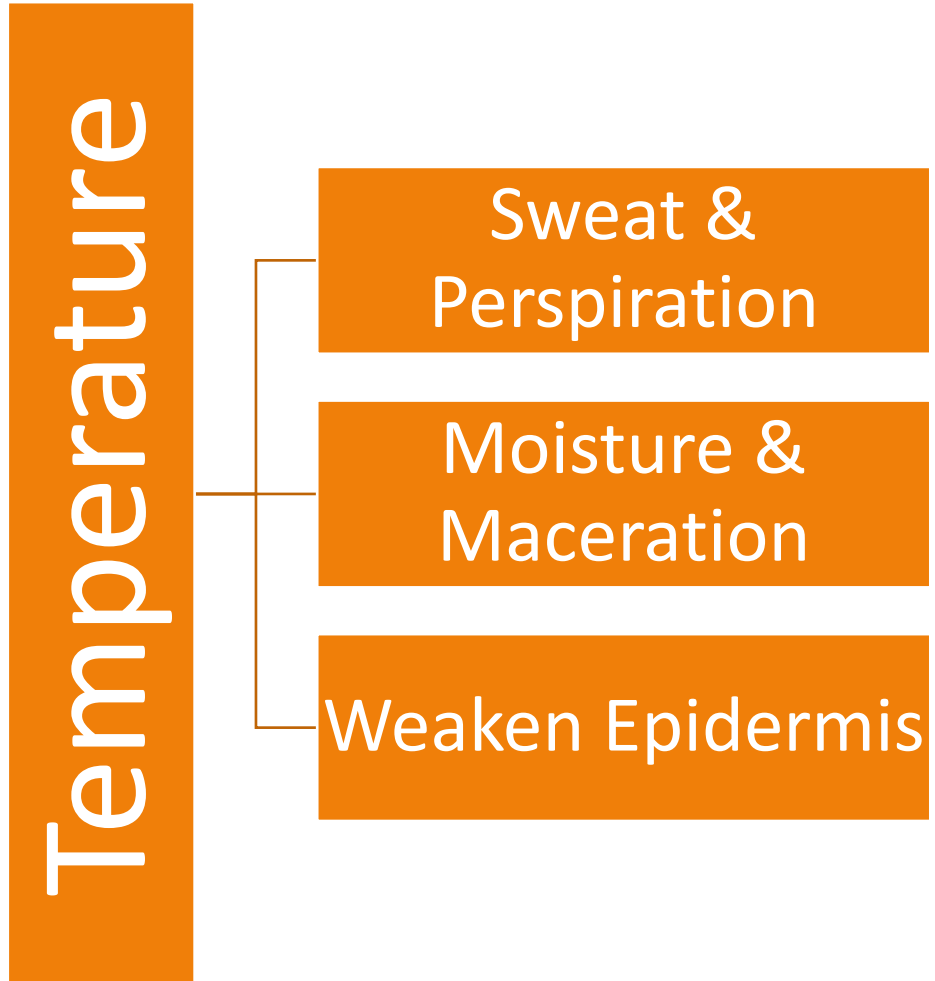
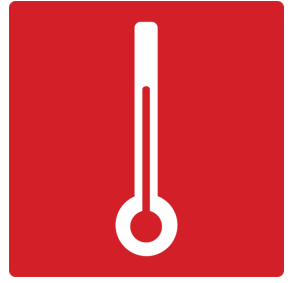
Follow Manufacturer Instructions for Use (IFU) ⁴



Maintain Microclimate and Normothermia ⁴



Microclimate ⁴¹

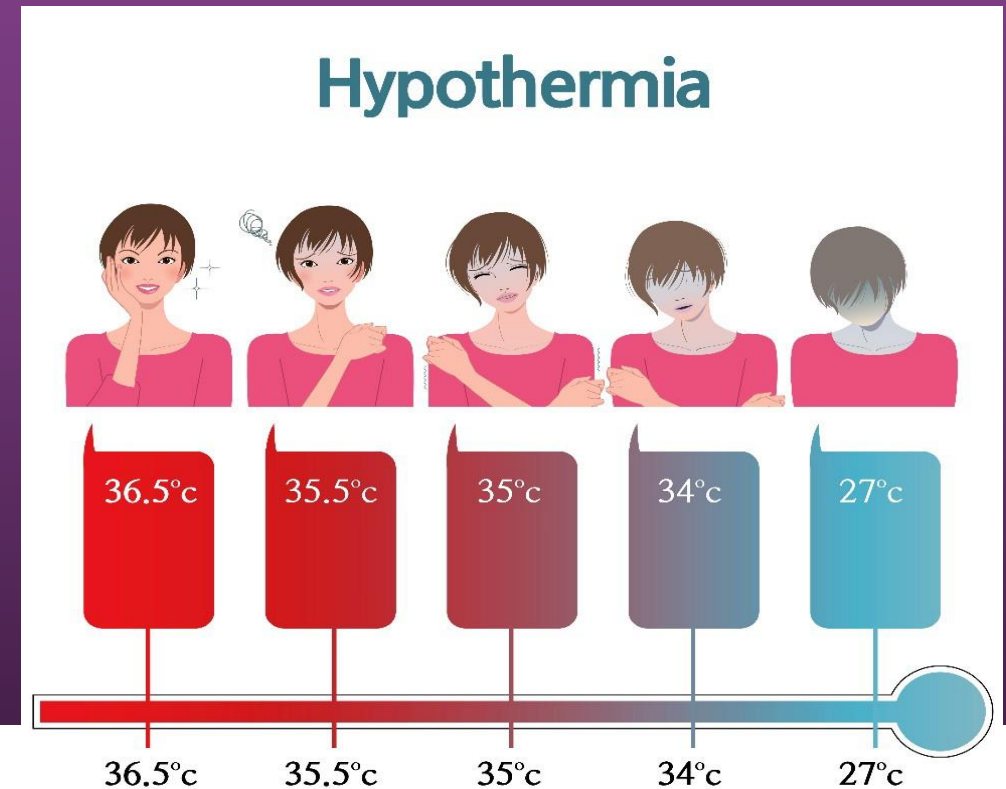


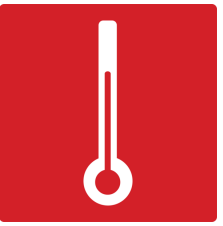
Yoshimura indicated excessive perspiration and body temp greater than 100.6 F (38 C) were risk factors in the park bench position.



Hypothermia ⁴²

- Fred et al. 1 degree F (1.8 degree C) body temperature decrease was linked with a higher rate of PI. ⁴¹
- Hypothermia is associated with increases in SSI, PI, LOS, and mortality





Key Drivers ⁴

- Warming blankets forced air
- Cooled/warmed IV solutions
- Mechanical ventilation
- Room temperature
- Moisture wicking drapes for OR table
- Prophylactic dressings – Sacral
- External female urine collection

Hand Over Communication and Documentation

Communication Tools “IPASS” 43-45



Illness Severity

Patient Summary: Surgical Procedure

- Risk and skin assessments
- Type of surgery, position, time on table

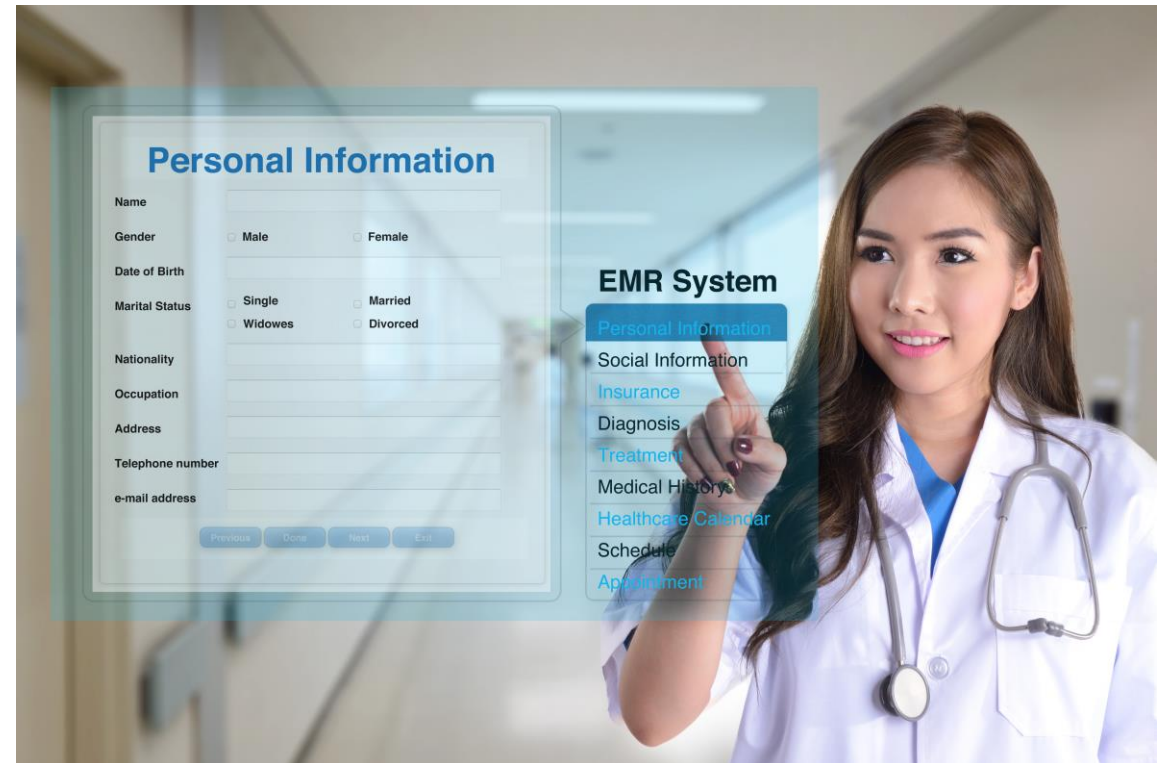
Action List: Consult WOC Nurse, Recheck sacral area in 1 hour

Situational Awareness and Contingency Plan

Synthesis by Receiver

Document the Following 4,14

- Pre and postoperative skin and risk assessments
- Team members
- Patient position
- Extremity position
- Specific actions to prevent injury
- Type and location of devices



Close the Loop on Reporting ⁴⁶



Quality Improvement

Conclusion



Assess

Plan

Competency

Documentation

Thank You Very Much!

How it
started...
How it's
going...



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