EXPLORING PRESSURE INJURIES IN THE CRITICAL CARE POPULATION

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OBJECTIVES

- Describe current clinical challenges in pressure injury risk assessment in the critical care population.
- Describe current pressure injury risk factors that confront the critical care population.
- Describe current clinical challenges in pressure injury prevention in the critical care population.

FLORENCE NIGHTINGALE

CRITICAL CARE UNITS-PAST

Circa 1955

"Special unit saves lives"

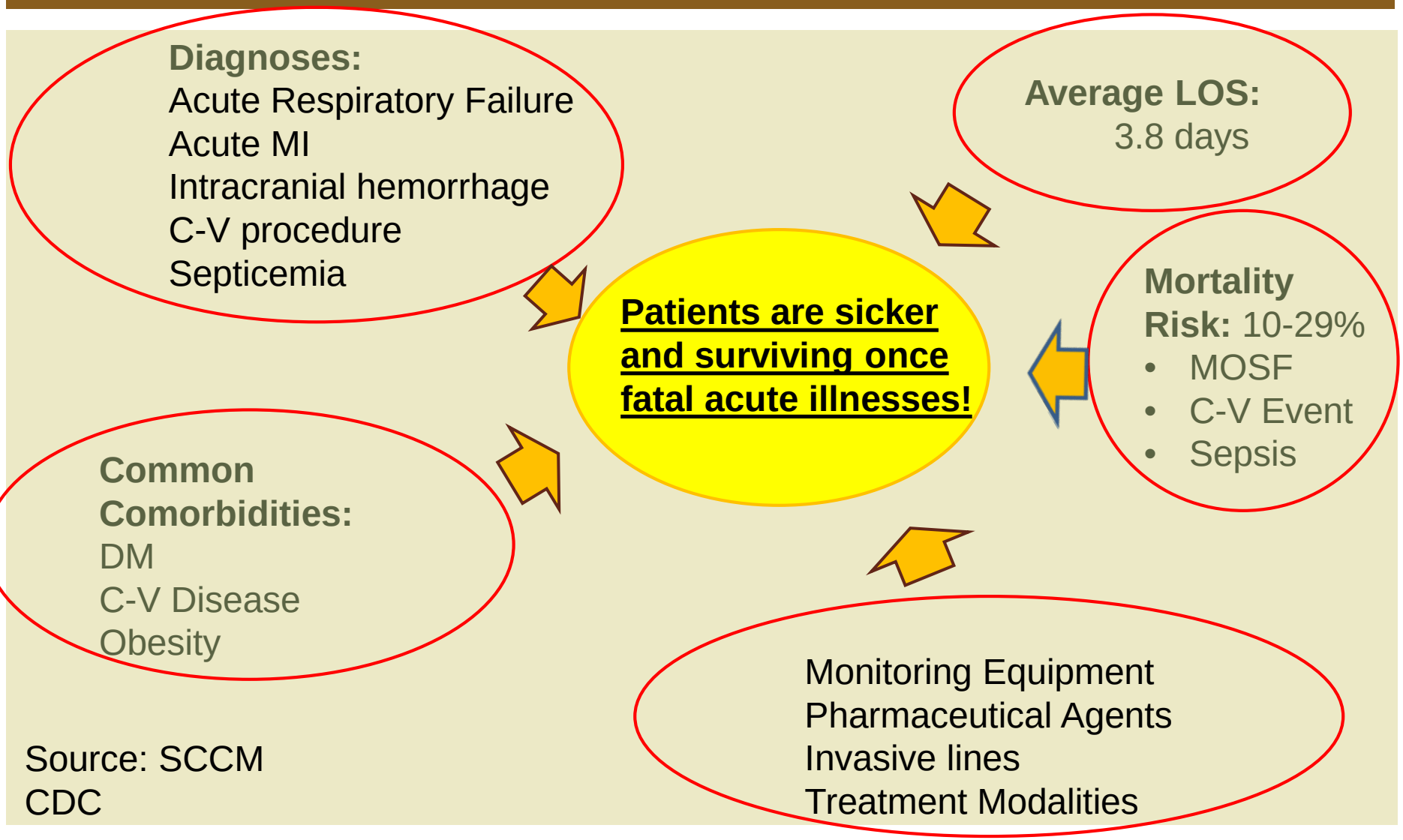
Circa 1980

CRITICAL CARE UNIT- PRESENT

- 27% of all hospital admissions involve ICU stay
- 2.5 times more costly than other hospital admissions
- ICUs led by critical care specialists (intensivist)

HCUP, 2014

SNAPSHOT OF CRITICAL CARE PATIENTS: UNITED STATES



Source: SCCM
CDC

Why study pressure injuries in ICU patients?

CRITICAL CARE POPULATION

- Sickest patients in our healthcare system
- Highest Prevalence Rates
- Ground Zero for PI development among hospitalized patients.

SNAPSHOT OF CRITICAL CARE PATIENTS
WITH PRESSURE INJURIES

Top Comorbidities
Diabetes
C-V Disease

Age
60-73 years

Average LOS
≥ 9 days

Top ICU Diagnoses
Respiratory Failure
Cardiac Related Events
Trauma
Sepsis/Septic Shock

Treatment Associated Factors
Mechanical Ventilation
Vasopressor Agents
Immobility

Mortality/Severity Of Illness
APACHE II: 9.5-22
(8%-40%) mortality risk

Pressure Injury Characteristics

Epidemiology:
5%- 45%
Highly Variable!

Most Common Stages:
Stage 2
Recent studies:
DTPI

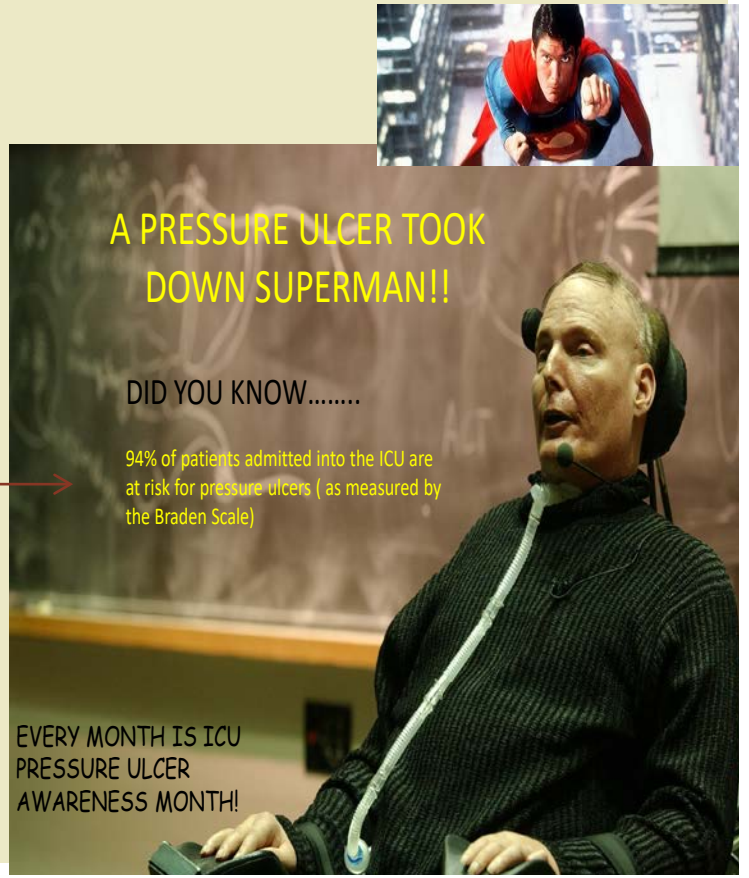
Location:
Sacrococcygeal

Days into the ICU
Admission HAPI developed:
First Week

OUR JOURNEY (2006-PRESENT……)

- Compliance to PI Risk Assessment
- Tracked compliance to PI prevention strategies
- Purchased critical care beds with low air loss surfaces in 2007 and again in 2015.
- Pressure Injury Prevention Awareness Campaigns

STILL HIGH PI RATES!



QUESTIONS

- Can we truly **capture PI risk** in critical care patients using current risk assessment tools?
- What are the **risk factors contributing to PI** development that need greater consideration in the critical care population?
- Do current **prevention strategies mitigate PI risk** or could these risk factors be non-modifiable?

Risk Assessment in the Critical Care Population

CURRENT RISK ASSESSMENT SCALES USED IN THE ICU SETTING

- Braden Scale- United States
- Jackson-Cubbin Scale: Europe
- Waterlow Scale: Europe

BRADEN SCALE
SEMINAL WORK IN THE ICU

Bergstrom et al (**1987**): 60 ICU patients

Conclusions from initial study:

- *The critical cut-off point at which the patient could be judged to be at risk for pressure sore formation was a Braden Scale score ≤ 16.*
- *Less tendency to overpredict than Norton scale*

ATTRIBUTES

- Most widely used RAS in the U.S.
- Provides uniformity to risk assessment
- Structured reminders for staff
- Defined risk factors
- Easy to complete

ELEMENTS OF PREDICTIVE VALIDITY

- **Sensitivity**: what % of patients who developed a PI were classified as at risk?
- **Specificity**: what % of all patients who remained PI free were classified as not at risk?
- **Predictive Value of Positive Test**(PVP): How well does the scale prospectively predict who will develop a PI?
- **Predictive Value of a Negative Test**: (PVN): How well does the scale prospectively predict who will not develop a PI?
- **Receiver Operating Characteristic Curve (ROC):** Balance of Sensitivity/Specificity

ICU Studies: Braden Scale

Study	Cut-off Score	Sensitivity	Specificity	PVP	PVN
Bergstrom et al.	16	83%	64%	61%	85%
Garcia-Hernandez	ND	87%	38%	49%	81%
Cox	18	100%	7%	20%	100%
Hyun	18	97%	16%	10%	98%

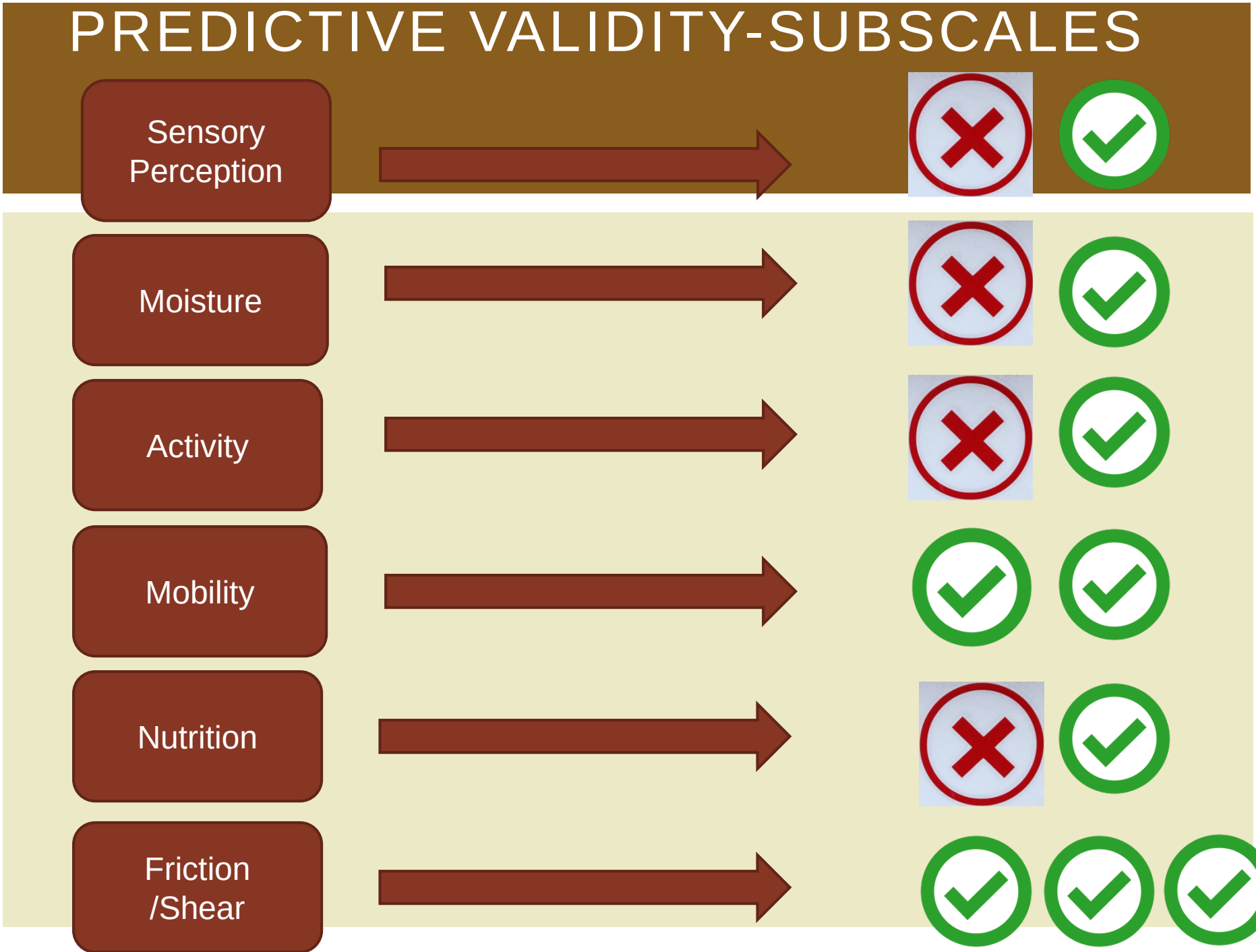
IS THE BRADEN SCALE PREDICTIVE IN THE CRITICALLY ILL POPULATION?

- **Total Braden Scale Score: Mixed in ICU Studies**
- **Low Specificity/Low PVP = High False Positive Rate**

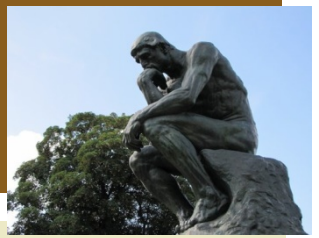
Overprediction

Need to consider PI prevention strategies in place with assessment of RAS Predictive Validity!

PREDICTIVE VALIDITY-SUBSCALES



QUESTIONS TO PONDER IN PI RISK ASSESSMENT IN CC PATIENTS



- Are we capturing true risk in this population?
- Are RAS better than clinical judgment?
  - Survey of Critical Care Nurses:
    - *My clinical judgment is better than any assessment scale for risk for pressure ulcers available to me. (n = 330)*

      25% agreed; 45% disagreed; 30% neither agree/disagree *(Cox & Schallom, 2017)*

Studies are mixed(NPUAP, 2014)

Can we measure PI risk using a more efficient method?

Pressure Injury Risk Factors in Critical Care: What do we know today?

TOP 7 PRESSURE INJURY RISK FACTORS

- **Age**
- **Length of ICU admission**
- **Cardiovascular Disease**
- **Diabetes Mellitus**
- **Perfusion(hypotension)**
- **Vasopressor Agents**
- **Mechanical Ventilation**

CATEGORIES

Demographic Variables
Age
Prolonged ICU admission

Comorbidities
C-V Disease
DM

Iatrogenic Factors
Vasopressors
Mechanical Ventilation

Intrinsic Factors

Hypotension

RISK FACTORS-DEMOGRAPHIC

Age: #1

Most frequently reported predictor.

Mean age across studies:

55-69: all patients

60-73: PI + patients

Older, but not elderly!

Length of Stay: #2

PI free: 3-14 days

PI Positive: 9-24 days

Factor of time?

Proxy for overall severity of illness?

Time to PI development:

First week of ICU stay

RISK FACTORS-COMORBIDITIES

Diabetes Mellitus

Prevalence of DM on the rise!

Microvascular changes:

capillary damage from oxidative stress/free radicals, poor perfusion

Macrovascular changes:

PAD, CAD, CVA

Cardiovascular Disease

CAD risk ↑ with DM

Atherosclerotic plaques

IMPAIRED TISSUE OXYGENATION AND PERFUSION

RISK FACTORS: INTRINSIC HYPOTENSION

Hemodynamic instability- a primary reason for ICU admission!

Defined: Systolic < 90 mmHg;

MAP < 60-70 mmHg; or

↓in systolic BP of 40 mmHg

Poor perfusion- circulation shunted from periphery to preserve vital organs affecting tissue tolerance

RISK FACTORS: IATROGENIC/CARE RELATED
VASOPRESSOR AGENTS

- **Increase MAP to improve tissue oxygenation and perfusion**
- **Administered in profound hypotension unresponsive to fluids- shock states**

- **Empirical Evidence:**
  - **Vasopressor agents predictive (no specific agents)**
  - **Norepinephrine and Vasopressin → Predictive**

<u>Side effects</u>: Inadequate perfusion of the extremities, mesentery, kidneys

VASOPRESSOR AGENTS PRESSURE INJURY CONSIDERATIONS

VASOPRESSIN:

- **Second line agent for refractory vasodilatory shock states (i.e. septic shock)**
- **Given with another vasopressor agent**
- **Does the addition of a second line agent create a "tipping point" that accelerates pressure injury risk?**
  - **Is it the pharmacodynamics of the vasopressors?**
  - **Is it the hypotension that necessitates the use of the agent?**
  - **Is it the overall burden of illness experienced by the critically ill patient who needs vasopressors?**

Is it the perfect storm?

- **New vasopressor agent- Angiotensin II (Giapreza)**

Caveat: Can't terminate these agents to mitigate PI risk!

RISK FACTORS: IATROGENIC/CARE RELATED MECHANICAL VENTILATION

Respiratory Failure: most common ICU admitting diagnosis.

Indications: Spontaneous respirations cannot sustain life→ impaired tissue oxygenation and perfusion.

Considerations in PI Risk:

- **?Reflection of overall burden of illness**
- **? Proxy for immobility**
- **?Related to Shear- continuous HOB ↑**

This is a life saving modality: non-negotiable to mitigate PI risk

WHAT ARE TWO COMMON ATTRIBUTES OF THESE RISK FACTORS?

Non-modifiable

Not included in current formal PI Risk Assessment

Ability to prevent some pressure injuries may be diminished in this population.

Strong potential for unavoidable pressure injuries exists in the critically ill population.

UNAVOIDABLE PRESSURE INJURIES

Despite best practice PIs do occur!!

Some situations favoring an unavoidable PI:

- Hemodynamic instability with repositioning
- Significant cardiopulmonary compromise→ impaired tissue oxygenation and poor tissue perfusion
- Shock states
- Initiation of live-saving modalities when:
  - PI prevention strategies would be contraindicated

    OR
  - Take priority over PI prevention

All situations applicable to the Critical Care Population!

UNAVOIDABLE PRESSURE INJURIES

Unavoidable pressure injuries *can only be determined if PI prevention strategies are consistently in use!*

OR IS IT ACUTE SKIN FAILURE IN THE CRITICALLY ILL?

- If the heart and lungs can fail, why not skin?
- A hypoperfusion state that leads to tissue death that occurs simultaneously to a critical illness.
- Pressure-related injury concurrent with acute illness as manifested by hemodynamic instability and/or major organ system compromise.

Problem: No clear cut diagnostic criteria to validate acute skin failure or distinguish acute skin failure from a pressure injury. More work to be done!

PRESSURE INJURY STAGES

PRESSURE INJURY STAGES

Stage 2

Partial-thickness loss of skin with exposed dermis. (NPUAP,2016)

Considerations:

- Top down development
- May be a friction component
- May be related to moisture
- Factors that impair tissue tolerance

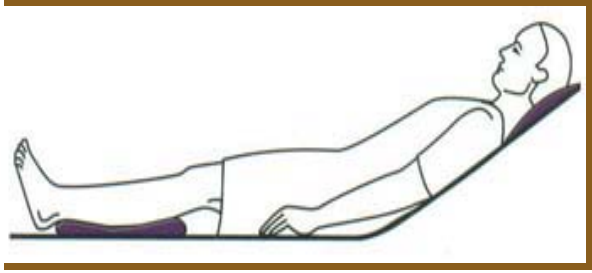
DEEP TISSUE PRESSURE INJURY RATES RISING!

Intact or non-intact skin with localized area of persistent non-blanchable deep red, maroon, purple discoloration or epidermal separation revealing a dark wound bed or blood filled blister. NPUAP,2016)

Rate: 9-12% nationally

- Tissue ischemia/tissue deformation
- Reperfusion Injury
- Shear injury- HOB elevation(MV;EN)
- Hypoperfusion states
  - Hypotension
  - Shock states

PRESSURE INJURY PREVENTION PRACTICES IN CRITICAL CARE WHAT'S THE EVIDENCE?



REPOSITIONING

- ***A change in position of the lying or seated individual performed at regular intervals with the purpose of redistributing or relieving pressure and enhancing comfort*.” (NPUAP, 2014)**
  - **Reposition all individuals** at risk of, or with existing pressure injuries, unless contraindicated
    - Strength of the Evidence= A

REPOSITIONING: CRITICAL CARE

Can critically ill, hemodynamically unstable patients be repositioned safely?

REPOSITIONING HEMODYNAMICALLY UNSTABLE PATIENTS

- Study in 4 ICUs in the U.S. (Mitchell et al, 2017)(AHRQ QI)(n=4075)
  - Studied frequency of inability to turn and reasons for not turning.

  Outcomes: **1 out of 6 deemed too unstable** to be turned developed a PI after 8 hours.

  Clinical situations that resulted in inability to turn: hypoxia, BMI > 50, 2+ organs failing, vasopressors, hemodynamic instability, surgical procedure precluded turning

  Conclusion: Fewer than expected clinical situations resulted in inability to turn.

- **Evidence Review** (Krapfl et al, 2017)
  - **Insufficient evidence** at this time to conclude that incremental repositioning of hemodynamically unstable patients deemed to unstable to turn reduced PI rates in ICU population.

REPOSITIONING TECHNIQUE

Team approach: adequate staff to assist

- Turning Trials every 8º
- Secure all lines
- **Slow incremental turns** to allow for the adjustment of the body to gravitational changes
  - 15° Pause15 seconds
  - 30° Pause15 seconds
  - 45° Pause 15 seconds
- Completion of turn and nursing tasks.
- Returned to 30° position using incremental shifts, wedges, pillows.
- Hemodynamics monitored for 10 minutes to determine if measures stabilize and patient recovers.

- Photo courtesy of Tod Brindle MSN, RN ET CWOCN and Linda Currie MSN, RN, ACNS-BC, CCRN-CSC Virginia Commonwealth University Medical Center

WHAT IS THE OPTIMAL TURNING FREQUENCY FOR CRITICAL CARE PATIENTS?

- Prospective, observational study: average time to turn in the ICU →**4.85 hours** (Goldhill et al, 2008)

- Prospective, observational study: **mean time to repositioning for all ICU = 2 hours(+/- 30 minutes);** Respiratory patients positioned more frequently in semi-Fowlers; Obese patients positioned most frequently in supine position. (Tayyib et al , 2013)

- RCT: **No significant difference in PI rates when turning frequency ↓ to 4 hours vs. 2 hours** in mechanically ventilated ICU patients on alternating pressure pad. Increase in adverse events noted with more frequent repositioning. (Manzano, et al 2014)

EVALUATING OPTIMAL PATIENT-TURNING PROCEDURES FOR REDUCING PRESSURE INJURIES

Purpose

Investigate efficacy of a wireless patient monitoring system for optimizing delivery of patient turning and subsequent reduction of HAPUs

Design

- Pragmatic, open-label, two-arm, prospective, RCT in two ICUs
- 1,226 patients (671 treatment & 555 control).

Findings

- 43% increase in q 2-hour repositioning compliance
- HAPU rates: Treatment = 0.7%
  Control = 2.7%

A decreased PI rate of 73% (OR=0.27, 95% CI [0.10, 0.75], p=0.01) (Pickham et al, 2018).

SUPPORT SURFACES?

- RCT: **No significant difference** in PU rates in ICU patients on 2 different types of viscoelastic foam. (Ozyurek et al,2015)
- Prospective Observational: **Lower incidence of PU** in critically ill patients on **LAL support surfaces** with microclimate management as compared to integrated power air redistribution beds (Black et al,2012)
- Quasi-experimental: **Alternating pressure mattresses were more effective** than alternating pressure air **overlays** in preventing PU in mechanically ventilated ICU patients.(Manzano et al, 2013)
- Pilot RCT: **Lower PU rates** in ICU patients placed **on an active alternating pressure surfac**e versus a manually inflatable static low pressure mattress. (Melbrain, 2010)

DO ASSISTIVE DEVICES REDUCE PRESSURE INJURIES IN THE CRITICALLY ILL?

Turning/Positioning Devices

- ↓PI Rates
- ↓Time/Staff Utilization
- ↑Staff Compliance
- Improved turning angles

Powers, 2016
Hall et al, 2016

Conformational Positioners

- ↓Buttock PIs
- ↓↑ Patient comfort
- ↓↑ ease of positioning obese pts.

Brennan et al, 2014

DO ASSISTIVE DEVICES REDUCE PRESSURE INJURIES?

Continuous Pressure Mapping

(Beherndt et al, 2014)

- Real time visual feedback regarding body positioning

↓PI rates

Non-invasive Perfusion Enhancement System

(Bharucha et al, 2018)

Goal: avoid prolonged vascular compression to the sacrum to improve tissue perfusion

- ↓Sacral PI as compared to alternating pressure surface

OTHER CLINICAL CONSIDERATIONS IN REPOSITIONING

Increase Nurses' Knowledge of Proper Techniques

Presence of WOC Nurse

(Anderson et al, 2015)

Staff Education

(Tayib et al, 2016)

Human Resource Considerations

Turn Teams (2 trained PCAs) (Still et al, 2013)

RN to verbally cue staff

(Harmon et al 2016)

HOB elevation: a competing strategy?

HOB elevation > 30 ^{0}

→ No increase in PIs

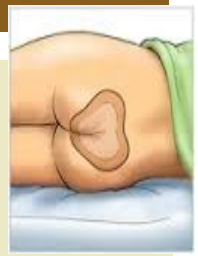
(Schallom et al 2015, Grap et al , 2018)

REPOSITIONING- POINTS TO PONDER

- **More research needed to determine optimal turning frequencies, positioning techniques and support surfaces.**
- **Do progressive mobility programs decrease PI occurrence in the ICU population?**

There will always be critically ill patients that are too unstable to be turned- Document it!

PRESSURE INJURY PREVENTION IN THE ICU
PROPHYLACTIC DRESSINGS



Strengthening evidence to support this modality in ICU patients.

- **Implementation Considerations**:
  - Strict criteria needed to determine eligible patients to decrease overuse, misuse and associated costs.
  - Standardized Protocols for assessment parameters, dressing change intervals, discontinuing dressings.

More rigorous studies needed to fully understand the role of prophylactic dressings in PI reduction in this population.

NUTRITIONAL CONSIDERATIONS

***Due to insufficient evidence to support of refute the use of specific additional nutritional interventions in critical care patients**, specific additional nutrition interventions are not recommended for routine use in the population.*

(NPUAP, 2014 Strength of evidence = C)

*There is currently **no clear evidence of a benefit associated with nutritional interventions for either the prevention or treatment of pressure ulcers.** Further trials of high methodological quality are necessary.*

Cochrane Review, 2014

Difficult to measure nutritional status in CC patients

WHY?

Critical illness alters common nutritional markers →inaccurate diagnosis of malnutrition.

- **Fluid shifts erroneously influence body weight**
- **Markers associated with inflammation, also associated with nutrition**

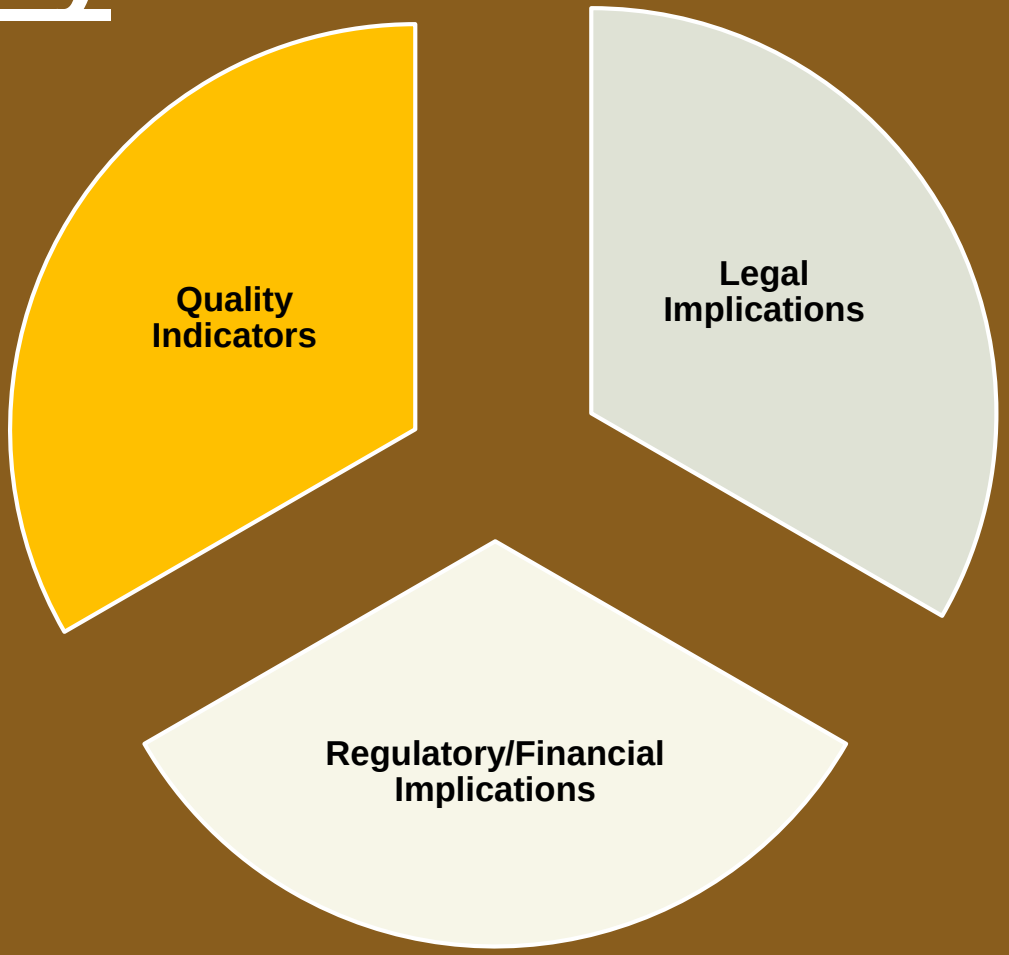
UNDERSTUDIED thus UNDERAPPRECIATED!

NUTRITIONAL GUIDELINES ICU

A.S.P.E.N. / SCCM GUIDELINES-2016

- Early feedings ideally within the first 24-48 hours after admission.
- Preferred route for feeding= enteral route (lower infection rates)
- Use of a feeding algorithm

Challenges in Practice Today



Financial/Regulatory

- Present on Admission Indicator
- The Hospital-Acquired Condition (HAC) Reduction Program: pay-for-performance program

Mandatory State Patient Safety Reporting Requirements

N.J. "Stage III or IV pressure ulcers acquired after admission… to a health care facility**."**

What about PIs that occur or worsen for which acute care clinicians believe they have little external control and cannot mitigate pressure injury development?

QUALITY

The National Database of Nursing Quality Indicators® (NDNQI®) Hospital acquired pressure injuries are nurse sensitive quality indicators, linking PI occurrence to the quality of care delivered by nurses.

Is PI development a Nurse Sensitive Indicator or Patient Sensitive Indicator?

Are acquired PIs only a reflection of nursing care?

Currently even PIs which may have been unavoidable are counted in NDNQI reporting

PROBLEM

Potentially inflates the reported PI rate artificially, coupled with possible negative connotations regarding the nursing care delivered.

LEGAL IMPLICATIONS/PUBLIC PERCEPTION

Over 17,000 lawsuits filed related to pressure injuries annually, second only to wrongful death, and more common than patient falls.[37]

What about nurses and other caregivers who find themselves involved in litigation over HAPIs that were not the result of suboptimal care?

CONCLUSIONS

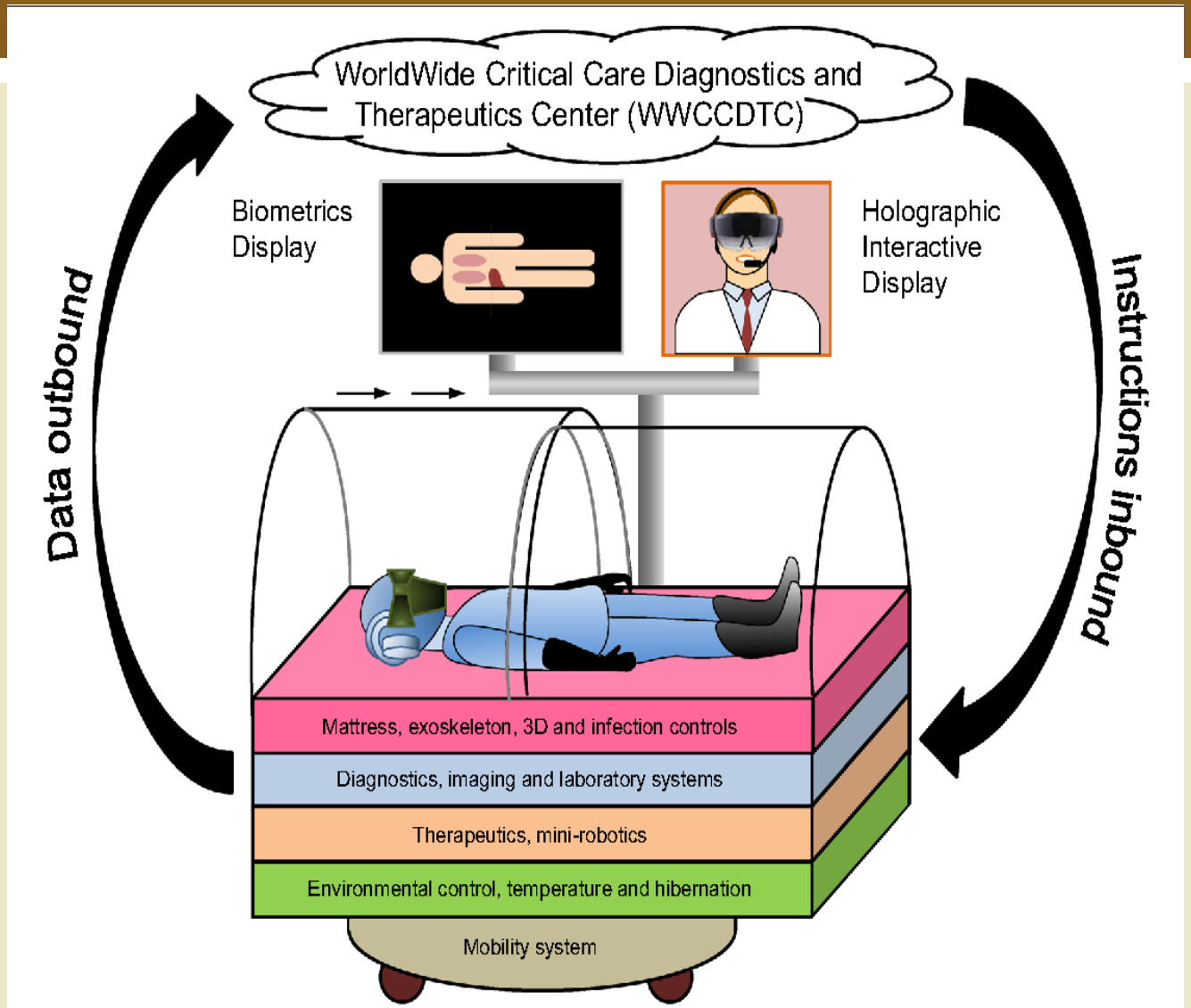
WHAT WE KNOW

- **PI risk in the ICU population is multifactorial and complex!**
- **Some PIs cannot be prevented in the ICU population!**
- **Evidence base surrounding many PI prevention strategies is weak!**

WHAT WE STILL NEED TO DO

- **Improve Pressure Injury Risk Quantification in the ICU population.**
- **Substantiate the label of the "Unavoidable Pressure Injury" in the acute care setting**
- **Continue to improve our evidence base surrounding PI risk factors and PI prevention**

LOOKING TOWARDS THE FUTURE: THE ICU IN 2050



J biosphere capsule. The ICU bed of the future will render care within a capsule that opens and closes and provides environment

Halpern et al, 2018


WORLD WIDE
PRESSURE INJURY
PREVENTION DAY
NOVEMBER 15, 2018
STOP
PRESSURE
INJURIES
www.npuap.org

THANK YOU!
QUESTIONS?

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