

# CURRENT CONCEPTS IN PRESSURE INJURY PREVENTION AND CARE

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HARBORVIEW ENDOWED PROFESSOR IN CRITICAL CARE NURSING

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## OBJECTIVES

- Describe and stage pressure injuries using current staging guidelines
- Choose strategies designed to reduce pressure injury
- Identify evidence and guideline based interventions for prevention and treatment of pressure injuries

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## PRESSURE INJURIES: FACT OR FICTION?

- PI develop because of poor care
- PI are preventable
- PI result from pressure
- Specialty equipment prevents PI
- Massaging reddened tissue can prevent a PI from developing

Makelbust and Sieggreen, 2001

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## OUTLINE

- Classification
- Pathways of injury
- Assessing risk
- Selected prevention measures
- Selected treatments

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## CLASSIFICATION—WHAT'S NEW?

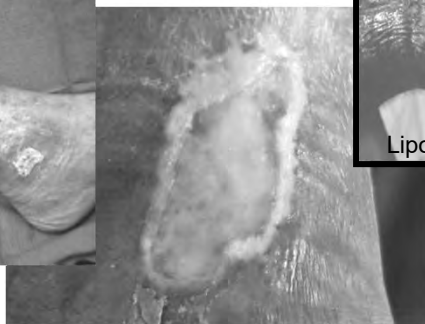
- Old—
  - Bed sore
  - Decubitus ulcer
  - Pressure ulcer
- New – Pressure injury
- Distinct from other chronic wounds
  - Venous, Neuropathic, Arterial

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## COMMON CHRONIC WOUNDS- VENOUS



Classic location and  
Hemosiderosis



Fibrinous Slough

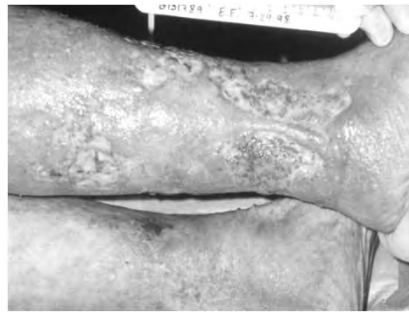


Lipodermatosclerosis

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## VENOUS ULCERS

- Lipodermatosclerosis & atrophie blanche
- Medial malleolus-gaiter area
- Irregular borders
- Exudative
- Aching pain worse at end of day relieved by elevation
- Base ruddy often with slough



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## COMMON CHRONIC WOUNDS- NEUROPATHIC



Commonly on plantar surface  
Peri-wound callous is often present



## WOUNDS-ARTERIAL

- Absence of palpable pulses
- Pain with elevation
- Absence of hair
- Atrophy below level of occlusion
- Shiny taunt skin at LE
- Cool LE
- Distal wounds
- Punched out appearance of wound



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## PRESSURE INJURY DEFINITIONS-SOME CHANGES

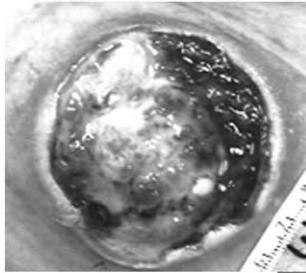
### ■ National Pressure Advisory Panel

A PI is localized damage to the skin and/or underlying soft tissue usually over a bony prominence or related to a medical or other device. Can present as intact skin or an open ulcer and may be painful. The injury occurs as a result of intense and/or prolonged pressure or pressure in combination with shear. The tolerance of soft tissue for pressure and shear may also be affected by microclimate, nutrition, perfusion, co-morbidities and condition of the soft tissue.

[www.npuap.org](http://www.npuap.org)

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## EXAMPLES

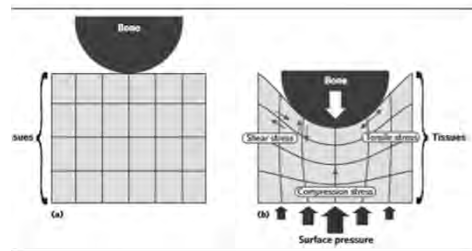
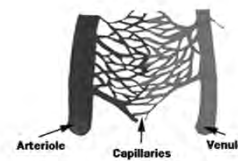


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## PATHWAYS OF INJURY-WHAT'S NEW?

### ■ Pressure

- 12-32 mmHg “closing pressure”
- Varies widely with location, age, disease



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International Review Consensus Document London: Wounds International, 2010

## PRESSURE AND TISSUE TOLERANCE

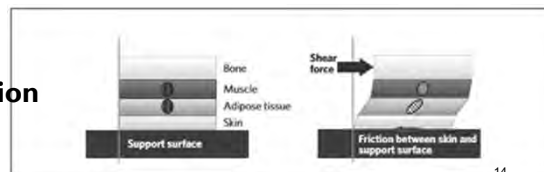
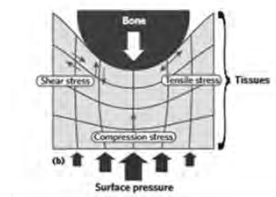


- Pressure
  - Intensity
    - Pressure restricting blood flow
  - Duration
    - Interaction with intensity
  - Tissue Tolerance
    - Skin integrity
    - Microclimate

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## PATHWAYS OF INJURY

- Pressure
- Friction
- Shear
  - Gravity + Friction



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International Review Consensus Document London: Wounds International, 2010

## PATHWAYS OF INJURY “MICROCLIMATE”

- **Humidity**

- Interface of skin and support surface

- **Moisture**

- Skin surface, sub epidermal

- **Temperature**

- Low or high levels increase risk

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## HOW BIG IS THE PROBLEM?

- Prevalence in high risk settings

- Acute Care: 12-18%
- Intensive Care: 22-49%
- Long Term Care: 8-53%
- Home Care: 0-29%

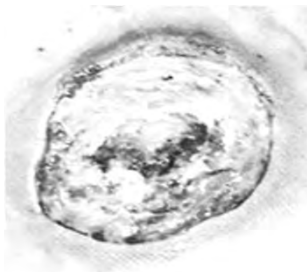


Tayyab et al 2016; Mallah et al 2015

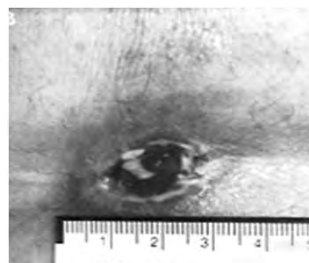
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## LTC AND ICU EXAMPLES



LTC: 72 yr. old man, Dementia, Parkinson's, CAD, HTN; Stage 4 18cm, medial malleolus (6 weeks)



ICU: 70 yr. old man s/p CABG; Stage 4 3cm, coccyx (1 month)

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### Review

#### Patient risk factors for pressure ulcer development: Systematic review

Susanne Coleman<sup>a,\*</sup>, Claudia Gorecki<sup>a</sup>, E. Andrea Nelson<sup>b</sup>, S. José Closs<sup>b</sup>, Tom Defloor<sup>c,1</sup>, Ruud Halfens<sup>d</sup>, Amanda Farrin<sup>a</sup>, Julia Brown<sup>a</sup>, Lisette Schoonhoven<sup>e,f</sup>, Jane Nixon<sup>a</sup>

<sup>a</sup>Clinical Trials Research Unit, University of Leeds, UK

<sup>b</sup>School of HealthCare, University of Leeds, UK

<sup>c</sup>Department of Nursing, University of Ghent, Belgium

<sup>d</sup>Department of Health Services Research, Research Institute CAHIE, Maastricht University, Netherlands

<sup>e</sup>IQ Healthcare, Radboud University Nijmegen Medical Centre, Netherlands

<sup>f</sup>Faculty of Health Sciences, University of Southampton, Southampton, UK

### ARTICLE INFO

### ABSTRACT

#### ► Major Domains

#### ► Mobility/Activity

#### ► Perfusion

#### ► Skin/Pressure injury status

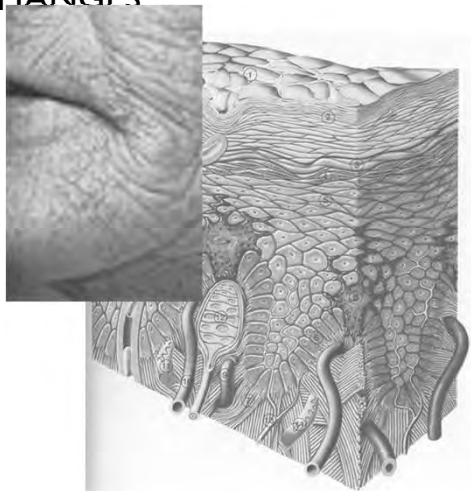
#### WHO IS AT RISK?

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## Skin changes with aging

### AGE RELATED SKIN CHANGES

- Epidermal thinning
- Flattened layers
- Reduced barrier and immune functions
- Less elasticity and adipose layer
- Melanocytes
- Fragile capillaries



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## A NEW FRAMEWORK

**JAN**  
*Advancing Practice and Policy Worldwide through Research and Scholarship*

DISCUSSION PAPER

A new pressure ulcer conceptual framework

Suzanne Coleman, Jane Nixon, Joann Kien, Lyn Wilson, Elizabeth McGinnis, Carol Drakky, Nikki Stubb, Amanda Farn, Diane Dowling, Jon M.G.A. Schols, Janet Giddings, Dan Belonging, Edward Jaki, Peter Vowden, Louise Schoonhoven, Dan L. Baker, Anne Gaten, Gert W.J. Onnen & E. Andrea Nilsson

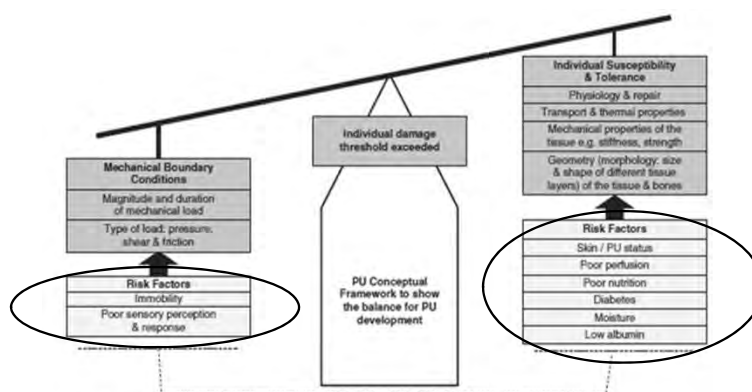
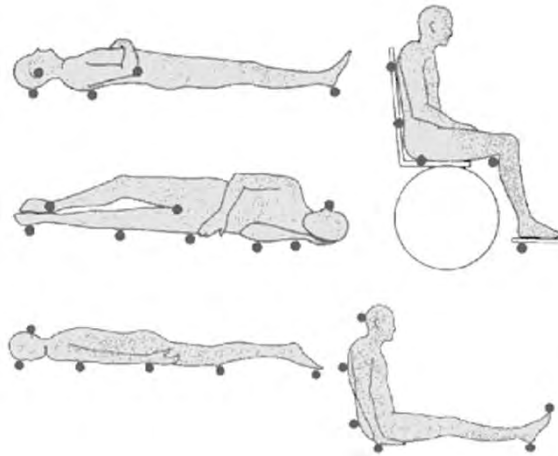


Figure 3 New pressure ulcer conceptual framework.

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J Adv Nurs 2014, 70(10), 2222-34

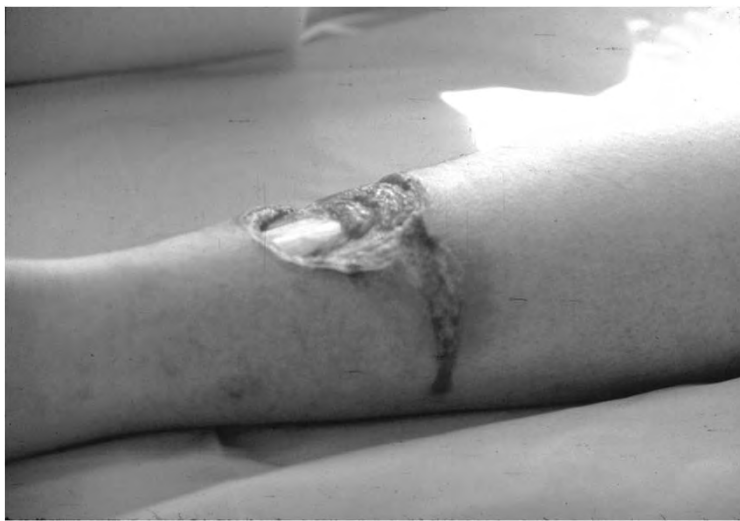
## COMMON LOCATIONS



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<http://www.health.nsw.gov.au/hospitalinfo/measures/pressureulcers.html>

## AND UNCOMMON LOCATIONS....



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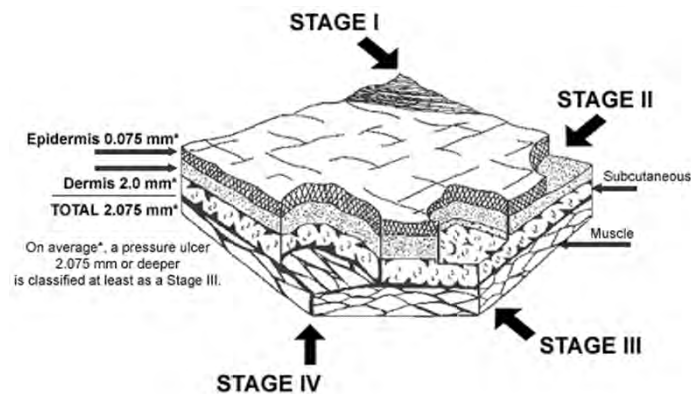
## DESCRIBING EXTENT OF INJURY

- Staging- assessment that classifies pressure injury based on anatomic depth of soft tissue damage
- Initial evaluation
  - Follows removal of necrotic tissue
  - Stage does not change
  - Reverse Staging is considered inaccurate
  - Used only for PIs



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## PRESSURE INJURY STAGING



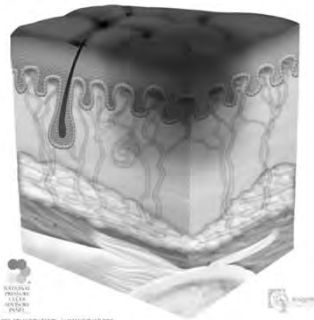
*Skin sample enlarged to show detail*

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## STAGE I PRESSURE INJURY



Stage 1 Pressure Injury – Darkly Pigmented



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## STAGE I PRESSURE INJURY

- Non-blanchable erythema of intact skin:
  - Intact skin
  - Skin temperature (warmth or coolness),
  - Tissue consistency (firm or boggy feel)
  - Color may vary by natural pigmentation

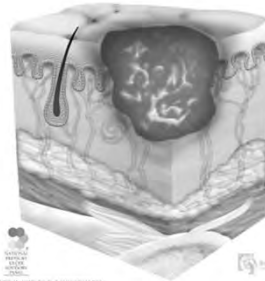
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## STAGE 2 PRESSURE INJURY



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Stage 2 Pressure Injury



INTERNATIONAL PRESSURE ULCER ADVISORY PANEL 1. WWW.NPIUP.ORG

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## STAGE 2 PRESSURE INJURY

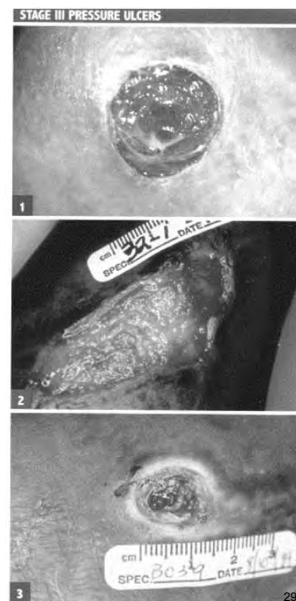
- Partial thickness skin loss with exposed dermis:
  - Pink, red, moist wound bed
  - Ø fat, or deeper tissues visible
  - Ø granulation tissue, slough, eschar
  - Not used for: dermatitis conditions or skin tears

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## STAGE 3 INJURY



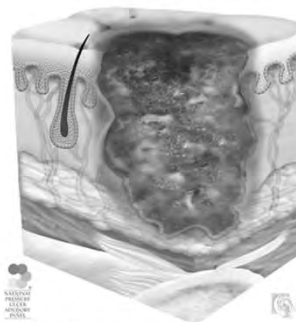
<http://www.burnsurgery.com/.../images/fig%2016a.jpg>  
<http://www.ruralfamilymedicine.org/educationalstrategies/.htm>



## STAGE 3 PRESSURE INJURY

- Full thickness skin loss:
  - Fat, granulation visible
  - May have slough or eschar
  - May have undermining or epibole
  - Ø visible fascia, muscle, tendon, ligament, bone

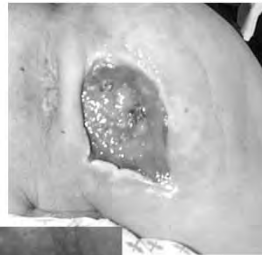
Stage 3 Pressure Injury



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## STAGE IV PRESSURE ULCER



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<https://www.flickr.com/photos/drewmgriffin/1807430966>

## STAGE 4 PRESSURE INJURY

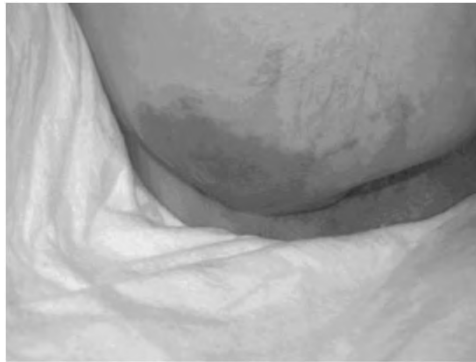
- Full thickness skin and tissue loss:
  - Exposed fascia, muscle, tendon, ligament, cartilage or bone
  - Slough or eschar may be present
  - May have epibole, undermining, tunneling
  - Depth varies by anatomical locationNew

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## DEEP TISSUE PRESSURE INJURY

Classification?



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## DEEP TISSUE PRESSURE INJURY

- Intact or non-intact skin
- Persistent non-blanchable area
- Deep red, maroon, purple or epidermal separation
- Dark wound bed or blood filled blister

Deep Tissue Pressure Injury



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## UNSTAGEABLE PRESSURE INJURY

- Obscured full-thickness skin and tissue loss
  - Cannot confirm extent of injury
  - Assumed Stage 3 or 4



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## OTHER PRESSURE INJURIES

Medical Device Related



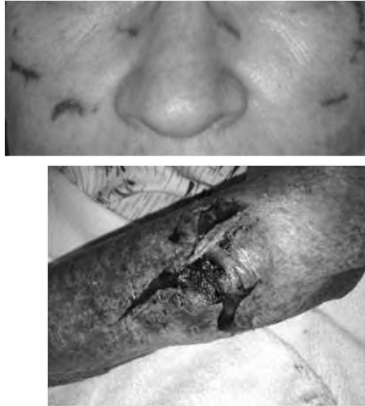
Mucosal membrane injury



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## OTHER SKIN INJURIES

### Skin tears



### Incontinence Associated Dermatitis 'IAD'



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## PREVENTION AND TREATMENT GUIDELINES

- [www.npuap.org](http://www.npuap.org)
- [www.epuap.org](http://www.epuap.org)
- [www.awma.com.au](http://www.awma.com.au)
- [www.etnurse.com.hk](http://www.etnurse.com.hk)
- [www.nzwcs.org.nz](http://www.nzwcs.org.nz)
- [www.woundhealingsociety.org.sg](http://www.woundhealingsociety.org.sg)
- [www.internationalguideline.com](http://www.internationalguideline.com)



### Wound healing society 2015 update on guidelines for pressure ulcers

Lisa Oubla, MD, PhD<sup>1</sup>, Mike Roroff, BS<sup>2</sup>, Michelle Dizon-Velasco, RN, APRN, CWS<sup>3</sup>, Anne Alonzo, BS<sup>4</sup>,  
Barbara Adams, MD<sup>5</sup>, Margaret Muller-Solomon, MD, PhD<sup>6</sup>, Jackson D. Whitney, PhD, RN, CWCN, FAAN<sup>7</sup>,  
Jesse Carlisle, MD<sup>8</sup>, Robert S. Kanner, MD, PhD<sup>9</sup>, Gayle M. Givens, MD<sup>10</sup>

### Quick Reference Guide



Copyright © National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel  
and the Pacific Pressure Injury Alliance  
ISBN 10: 0-927143-5-5  
ISBN 13: 978-0-927143-5-5

First published 2009  
Second edition published 2014

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## IS PREVENTION POSSIBLE?

### Assess risk

- Structured approach using scale
  - (e.g., Braden, Norton, Waterlow)
- Predictive validity varies by clinical settings
- Within 8 hours of admission & with condition changes
  - Mobility and activity
  - Skin status
  - Previous ulcer

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## ASSESS RISK

- |                                 |                                      |
|---------------------------------|--------------------------------------|
| ■ Perfusion/oxygenation         | ■ Additional factors:                |
| ■ Nutrition                     | ■ Body temperature                   |
| ■ Weight loss                   | ■ Age                                |
| ■ Total intake                  | ■ Sensory perception                 |
| ■ Albumin <3.5 significant risk | ■ Labs: albumin, Hb, creatinine, CRP |
| ■ Skin Moisture                 | ■ General health status              |

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## PREVENTION AND TREATMENT GUIDELINES



- Reduce pressure, friction, shear

- Turn, small position shifts
- Limit HOB elevation

- Provide nutrition

- Protein 1.2-1.5 g/kg/d
- 30-35 calories/kg/day
- Other nutrients

- Treat infection

- Prepare wound bed



- What about massage?

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## PREVENTION AND TREATMENT GUIDELINES

- Provide topical treatment

- Manage incontinence, protect skin

- Surgery

- Adjunctive therapies

- HBO
- Negative pressure
- Growth factors
- Skin substitutes
- Ultrasound
- Electrical stimulation

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## ALWAYS AVOIDABLE?



- 2014 Multidisciplinary conference concluded: “unavoidable pressure ulcers do occur.” (NPUAP *JWOCN* 41(4):313-34)
- 2017 “Given the clinical complexities and constellation of comorbidities commonly encountered in today’s healthcare environment, it is reasonable to state that not all pressure ulcers/injuries are avoidable or preventable.” (WOCN Position Paper, *JWOCN* 44(5):458-69.)

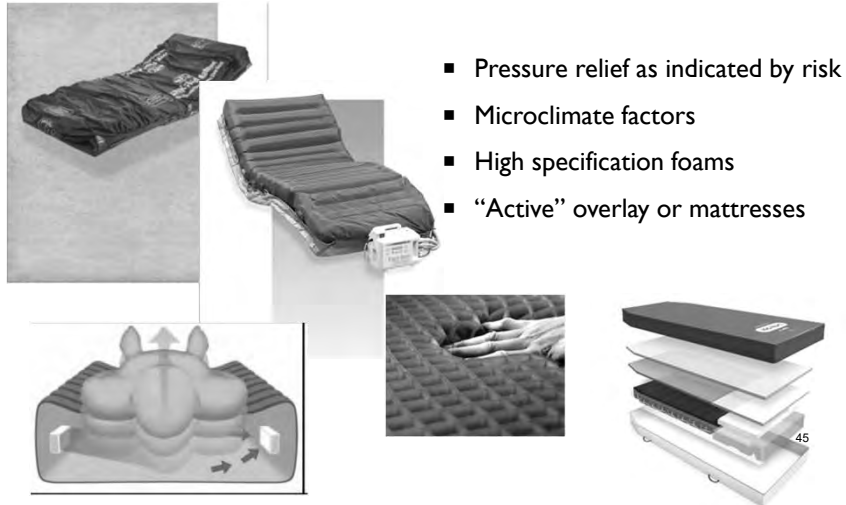
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## TAKING A CLOSER LOOK-SELECTED INTERVENTIONS

- Support surfaces
- Infection and wound bed preparation
- Topical treatments
- Adjunctive treatments

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## PRESSURE REDUCTION-WHAT ABOUT THE SURFACE?





## SURFACE TERMINOLOGY-REACTIVE SUPPORT



6 | INTERNATIONAL REVIEW: PRESSURE ULCER PREVENTION

## WHAT'S THE EVIDENCE?

- Higher- specification foam is better than standard hospital foam 
- Medical grade sheepskins offer preventive benefit 
- Merits of higher-tech constant low –pressure and alternating-pressure??
- Alternating pressure mattresses may be more cost effective than alternating-pressure overlays (UK data)



Cochrane Library  
Cochrane Database of Systematic Reviews

Support surfaces for pressure ulcer prevention (Review)

Mitchell S, Lippmanowicz A, Bellamy G, Bennett J, McMillan J, Connell N

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## RESULTS OF SYSTEMATIC REVIEWS – WOCN TASK FORCE FOR SUPPORT SURFACES

- “Insufficient evidence to conclude superiority of one type of support surface over another.”
- McNichol L, Watts C, Mackey D, Beitz J, Gray M. Identifying the right surface for the right patient at the right time: generation and content validation of an algorithm for support surface selection. *J Wound Ostomy Continence Nurse*. 2015; 42(1):19-37

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## SURFACES FOR OLDER ADULTS?

In medical surgical settings:

- “AP support surfaces seem to be effective in prevention of PUs in compared to standard foam mattresses.”
- No evidence to support one type of AP, or that AP are better than continuous low pressure.
- “Continuous low pressure seem effective in prevention of PUs compared to standard foam mattresses.”
- Australian medical sheepskin better than usual care.

Lozano-Montoya et al. 2016. Nonpharmacologic interventions to prevent pressure ulcers. An overview of systematic reviews. JAMDA 17, 370e1-370e10.

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## ADDITIONAL PREVENTION MEASURES

- Chair bound
  - Pressure releases every 15 minutes
- Relieve heel pressure
- Relieve pressure between joints
  - Knees and ankles
- HOB elevation below 30 degrees



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## INFECTION AND WOUND BED PREPARATION

- Pressure injury wounds and chronic wounds are colonized
  - Common pathogens: staph aureus, pseudomonas, ecoli
  - Often polymicrobial
- Infection- local, systemic
- Osteomyelitis: suspect in non-healing ulcers
  - 25-30% of non-healing Stage 4 ulcers
  - If + follow with bone biopsy and culture

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## WOUND BED PREPARATION DEFINED



- Removal from the wound of:
  - Necrotic Tissue
  - Non-viable Tissue
  - Slough
  - Foreign material



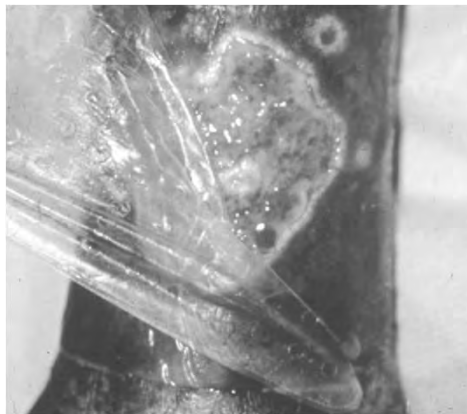
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## DEBRIDEMENT

- Selective-only necrotic tissue removed
- Non-selective-necrotic and viable tissue removed
- Types:
  - Mechanical
  - Chemical
  - Autolytic
  - Surgical or Sharp

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## DEBRIDEMENT- AUTOLYSIS



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## DEBRIDEMENT-ENZYMES



- Act on specific by-products, denatured collagen, protein, fibrin, DNA
- Prescription needed
- Cost effective cover dressing
- Fairly slow process

Image from Royal College of Surgeons Edinburgh. <http://www.edu.rcsed.ac.uk>

## DEBRIDEMENT- CHEMICAL AND BIOLOGICAL

- Dakin's Solution
  - Antimicrobial but also cytotoxic
  - Controls odor
  - Protect peri-wound skin
  - Controversial but has uses
- Larval
  - Secrete proteolytic enzymes
  - Fairly rapid, control odor
  - Confine maggots to wound
  - Protect peri-wound skin



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## DEBRIDEMENT- BIOLOGICAL



Initial application



Covering and containing



After 48 hours of Maggot therapy

## WHAT ABOUT BIOFILMS?

- Structure of microbial cells surrounded by self produced polymer matrix
  - One organism or polymicrobial
  - Chronic infections
- Concern for biofilms when:
  - Delayed healing – no change in 2 wks/present 4 wks
  - s/sx of inflammation
  - No response to antimicrobials
- Cannot identify with the naked eye
- Tolerance to abx treatment in 24-96 hrs

## TOPICAL CARE PRINCIPLES

- Match to patient/PI
- Cleanse/debride
- Bioburden/Biofilms
- Protect
- Provide physiologic environment
- Manage exudate, odor, dead space
- Modify as ulcer heals



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TO



## HOW TO DECIDE?



- ▶ Protection
  - Sealant, Film, Thin HCD or Foam
- ▶ Moisture
  - Film, Hydrogel, Moist gauze
- ▶ Exudate
  - Alginate, HCD, Foam, Filler + composite, Hydrofiber, Silver containing, Super absorbent, cadexmer
- ▶ Bioburden
  - ▶ Honey, silver containing, cadexmer iodine
- ▶ Odor
  - Impregnated gauze, Charcoal layer foam

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## Moisture retentive dressings- Hydrocolloids



- Benefits: provide moist wound surface, autolysis, protection
- Negatives: only absorb small to light moderate, can be occlusive, may cause stripping

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## Absorptive Dressings-Alginates



- Benefits: highly absorptive, autolysis, gentle
- Negatives: requires secondary dressing, can cause odor with dressing changes

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## Moisture retentive dressings- hydrogel sheets



- Benefits: provide moist wound environment, autolysis, may not need secondary dressing, soothing
- Negatives: some brands macerate, some require a secondary dressing.

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## Absorptive dressings-Foams



- Benefits: absorb drainage, protective, primary or secondary when used with adhesive border, decrease dressing freq.
- Negatives: cost, non-adhesive requires securing with tape or wrap.

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## Moisture retentive dressings- Hydrogels



- Benefits: provide moist wound environment, gentle autolysis, can impregnate on nugaue for tunneling
- Negatives: need secondary dressing, do not absorb, can macerate.

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## WHATS NEW? DRESSINGS AS PREVENTATIVE MEASURES

- Multi-layer soft silicone foam dressing
- Sacrum, heels
- Action- limit shear and friction
- Lab and clinical studies indicate reduction in pressure injury



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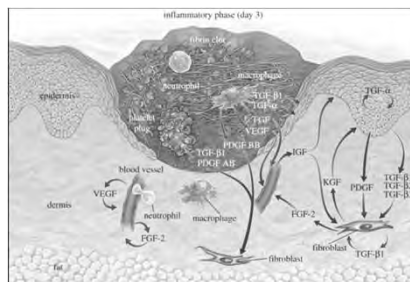
## ADJUNCTIVE THERAPIES TOPICAL, DEVICE, SYSTEMIC

- Growth factors
- Negative pressure wound therapy
- Electrical stimulation
- Hyperbaric oxygen therapy



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## GROWTH FACTORS?



- Part of normal healing
- PDGF, Platelet rich plasma
- Not currently approved for PI treatment
- Consider for Stage 3 or 4 if unresponsive to comprehensive therapy

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## NEGATIVE PRESSURE WOUND THERAPY?



- Applies negative pressure to the wound
- Removes exudate and debris
- Reduces edema
- Increases perfusion
- Stimulates granulation
- Consider for Stage 3 or 4 PI that have not progressed with standard care

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## ELECTRICAL STIMULATION



- Direct current
- High voltage pulsed current
- Consider for PI Stages 2-4 that have not responded to conventional therapy

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## HYPERBARIC OXYGEN

- Evidence of improved healing in other chronic wounds, ie Diabetic foot ulcers
- No evidence to have any effect in pressure injuries
- Not recommended at this time for routine use in PI

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## TIMEFRAME FOR HEALING



- Assess at least weekly
- Slow to heal – 75% Stage 2 heal by 8 weeks but only 17% of Stage 3/4
- Look for evidence of healing within 2 weeks of starting therapy
- Evidence of healing within 2 weeks predicts closure

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## REFERRALS

- Evidence of poor or slow healing
- Complex wounds, Lower extremity
- Patients with diabetes, venous or suspected mixed disease
- Wound Clinics or wound teams with expertise
- It takes a team!
  - Consult specialists
  - Labs
  - Biopsies
  - Radiologic studies

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## RED FLAGS



- Varying descriptions of ulcer
- Odd and unexplained locations
- Apparent disordered care
- Lack of ongoing evaluation
- Lack of care in response to changes in need
- Lack of evidence based or guideline based care
  - No longer recommended: heat lamp, antacids, “donuts”, massage

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## CASE EXAMPLES

- What type of ulcer?
- Important ulcer characteristics?
- What care is indicated based on wound management principles?
- Treatment options?
- Patient education?

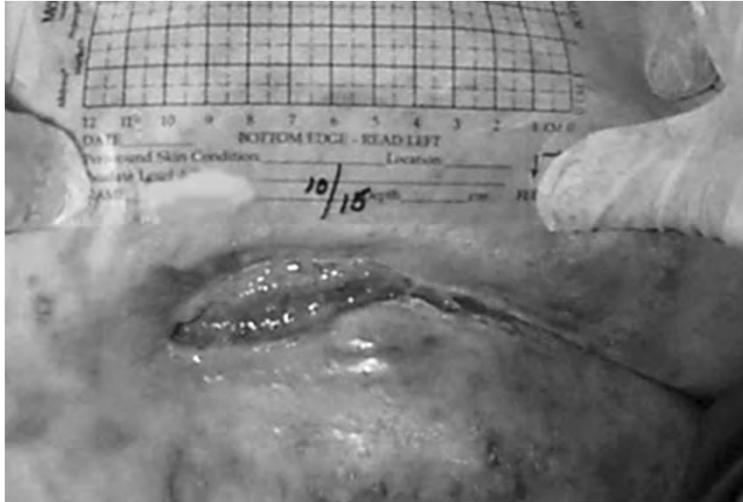
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Week 3: 123 cm<sup>2</sup>



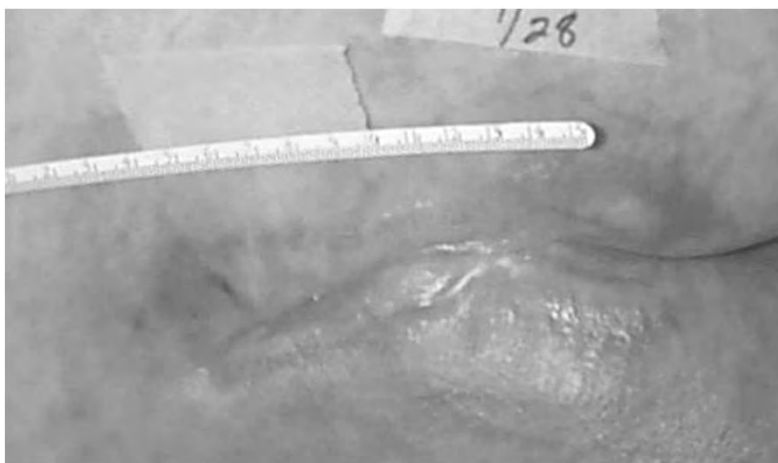
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Week 8: 8 cm<sup>2</sup>

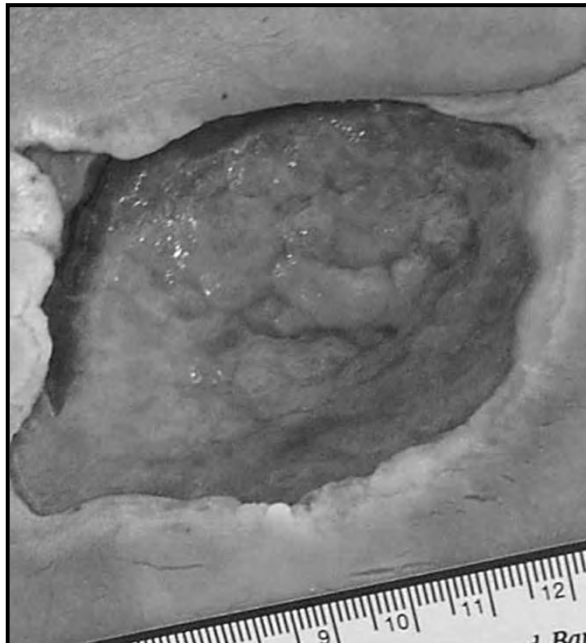


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Week 27: Healed



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## SUMMARY

- PU develop because of poor care
- All PU are preventable
- PU result from pressure
- Specialty equipment prevents PU
- Massaging reddened tissue can prevent a PU from developing

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## QUESTIONS?



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