Feeding Your Wound: Fuel to Heal

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Objectives

1. Examine the building block of nutrition (macronutrients and micronutrients) that dominate healing & discuss practical nutrition strategies for healing wounds.

2. Apply the 2014 National Pressure Ulcer Advisory Panel/European Pressure Ulcer Advisory Panel/Pan Pacific Pressure Injury Alliance nutrition guidelines into practice.

Pathogenesis of Pressure Injuries

### NPUAP Terminology Change

- April 2016 NPUAP consensus conference announced terminology change from pressure ulcer to pressure injury & validated new terminology, which more accurately describes pressure injury in intact and ulcerated skin.
- Previous staging system described both Stage 1 & Deep Tissue Injury as injured intact skin and the other stages described open ulcers.
- There has been confusion because the definitions for each of the stages referred to the injuries as “pressure ulcers”.

### Pressure Injury

**Pressure Injury:**
A pressure injury is localized damage to the skin and/or underlying soft tissue usually over a bony prominence or related to a medical or other device. The injury 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, comorbidities and condition of the soft tissue.

www.npuap.org

### Improving Medicare Post-Acute Care Transformation Act of 2014 (IMPACT)

- **Goal:** reform post acute care (PAC) payments & reimbursement while ensuring continued beneficiary access to the most appropriate setting of care.
- **Measure Domain:** skin integrity & changes in skin integrity
- **Outcome Measure:** Percent of residents or patients with pressure ulcers that are new or worsened.
Improving Medicare Post-Acute Care Transformation Act of 2014 (IMPACT)

• **Target Date** Oct. 2016: long term care hospitals (LTCHs), inpatient rehabilitation facilities (IRFs), and skilled nursing facilities (SNFs) to report standardized assessment data for the skin integrity and changes in skin integrity Quality Measure Domain (QMD)

• **QMD reports:** percent of patients/ residents with Stage 2-4 pressure ulcers that are new or worsened since admission.

Rationale for Pressure Injury (ulcer) QM

• Linked to malnutrition
• Increases mortality in elderly, 70% occur in adults > 70
• Longer hospital stays ↑ cost of care
• Cause discomfort & pain
• Can lead to sepsis & osteomyelitis
• Pressure injuries are high cost adverse condition across all settings
• Burden of litigation associated with pressure injuries

Quality Measure Description

• SNF Data: data from MDS 3.0 & measure is restricted to short-stay residents defined as ≤ 100 days in SNF
• LTCH Data: LTCH Care Data Set is for all patients
• IRF Data: IRF-PAI for IRF patients & limited to Medicare part A and C patients
• Data affects payment determination beginning 2018
• Nutrition interventions should be part of prevention & healing strategy for QMD
Age Related Skin Changes

- Flattening of the dermal epidermal junction
- Slower cell turnover, decreased elasticity
- Thinning of subcutaneous layers,
- Decrease in overall muscle mass,
- Decreased intradermal vascular perfusion and oxygenation.

Addressing the Skin Integrity QM Domain

<table>
<thead>
<tr>
<th>Nutrition Guidelines</th>
<th>Nutrition Care Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014 National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, Pan Pacific Pressure Injury Alliance Pressure Ulcer Prevention and Treatment Guidelines</td>
<td></td>
</tr>
</tbody>
</table>

NPUAP/EPAP/PPPI
A Pressure Ulcer Prevention and Treatment Guidelines
Individualized Nutrition Care

Goal of Guideline

• The goal of this international collaboration was to develop evidence-based recommendations for the prevention and treatment of pressure ulcers that could be used by health professionals throughout the world.
• Produced by the Guideline Development Group (GDG).
• Each section had a small work group (SWG) representatives from each organization.

Malnutrition

• Increases morbidity and mortality.
• Decreases function and quality of life.
• Increases frequency and length of hospital stay.
• Increases health care costs.

Inflammation and Malnutrition

Inflammation (d/t infection, injury, surgery, etc.): an important underlying factor that increases risk for malnutrition.

White J. J Acad Nutr Diet. 2012;112:730-730

Malnutrition and Pressure Injuries

- Pre-existing malnutrition/weight loss increased the odds of developing a PU 3.8 times. (2010)

- Australia, odds ration of having a pressure ulcer are higher with malnutrition in acute and LTC. (2010)

- Home care study in Japan: ≥ 65, rate of malnutrition 58.7% with pressure ulcers compared to 32.6% without them. (2010)

Nutrition Screening, Assessment, and Care Planning
**Nutrition Screening Tool**

- Quick and Easy
- Acceptable
- Validated

**Validated Screening Tools**

- **MNS**
  - Malnutrition
  - Valid and reliable for use in acute care and ambulatory care to identify malnutrition
  - Ferguson, M et al. (1999)

- **MNA**
  - Mini-Nutritional Assessment
  - Validated in individuals/Pus Langkamp-Henken et al. (2005)
  - Validated and easy to use in older adults
  - Paudlia (2012)

- **MUST**
  - Malnutrition Universal Screening Tool
  - To identify risk of undernutrition
  - Poulia et al. (2012)
  - Validated for use in older adults admitted to acute care

- **SNAQ**
  - Short Nutrition Assessment Questionnaire
  - Acute care, residential care and community adults
  - Neelemant et al. (2008)

**Mini Nutritional Assessment®**

- MNA®
  - Validated and easy to use in geriatric patients
  - Acute care, hospital based ambulatory care, LTC

- [http://www.mna-elderly.com](http://www.mna-elderly.com)
Malnutrition Universal Screening Tool

MUST
To identify risk of undernutrition (BAPEN, 2008)

BMI
Weight loss past 3-4 months
Acute disease (no intake >5 days)

http://www.bapen.org.uk/must_tool.html

Short Nutritional Assessment Questionnaire

SNAQ
Short Nutritional Assessment Questionnaire

• Did you lose weight unintentionally?
  More than 6 kg in the last 6 months
  More than 3 kg in the last month
  • Did you experience a decreased appetite over the last month?
  • Did you use supplemental drinks or tube feeding over the last month?

http://www.bapen.org.uk/must_tool.html

Braden Scale: Nutrition Subscores

Copyright 1988 Barbara Braden and Nancy Bergstrom

Refer to RDN
Comprehensive Nutrition Assessment

Academy’s Nutrition Care Process

Nutrition:
1. Assessment
2. Diagnosis
3. Intervention
4. Monitoring and Evaluation

Nutrition Assessment

<table>
<thead>
<tr>
<th>Medical Hx, Physical Exam</th>
<th>Diet History, Food Intake</th>
<th>Body Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis/recent changes in condition (depression)</td>
<td>Adequacy of food/fluid intake compared to needs</td>
<td>Height, weight, wt. history, UWL (≥5% in 30 days or ≥10% in 180 days), BMI &lt;19</td>
</tr>
<tr>
<td>Medications</td>
<td>Chewing, swallowing, self feeding, GI issues</td>
<td>Insidious weight loss</td>
</tr>
<tr>
<td>Risk or S/S of malnutrition, dehydration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Nutrition Assessment

<table>
<thead>
<tr>
<th>Current Interventions</th>
<th>Interviews</th>
<th>Nutrition Focused Physical Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food or dining related interventions</td>
<td>with resident, family and/or staff</td>
<td>Overall appearance/indicators of PEM</td>
</tr>
<tr>
<td>Oral nutrition supplements</td>
<td>Acceptance to interventions</td>
<td>Oral examination</td>
</tr>
<tr>
<td>Nutrition support</td>
<td>Compare goals to outcomes</td>
<td>Skin examination</td>
</tr>
</tbody>
</table>
Algorithm for Prevention of PUs

Trigger conditions: UWL swallowing problems, poor food intake, immobile, swallowing concerns, low PU risk assessment score, risk of malnutrition per validated nutrition screen.

Screen & Assess: using validated screening tool & refer to registered dietitian or nutrition team to assess & document malnutrition & PU risk.

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Nutrition Assessment

1. Assess weight status for each individual to determine weight history and significant weight loss from usual body weight (>5% change in 30 days or >10% in 180 days).
   SOE = C; SOR = Probably do it

2. Assess the individual’s ability to eat independently.
   SOE = C; SOR = Definitely do it

3. Assess the adequacy of total nutrient intake (food, fluid, oral supplements, enteral/parenteral feedings).
   SOE = C; SOR = Definitely do it

Dietary Intake

- Depression affects appetite of 30% of adult outpatients.
- Loss of appetite related to high risk of malnutrition.
- Increases risk of poor wound healing.
- Decreased ability to eat independently.
- ↑ Risk for undernutrition and delayed healing.

Horn 2004; Gilmore 1995
**What about Labs?**

No lab test can specifically determine an individual’s nutritional status.

- Serum protein levels may be affected by metabolic stress, inflammation, renal function, hydration and other factors.

**Inflammation and Stress→ Release of Cytokines**

![Diagram of cytokine effects on muscle wasting and albumin synthesis]

<table>
<thead>
<tr>
<th>Cytokines</th>
<th>Decreased nitrogen retention</th>
<th>Extravasation of albumin from intravascular spaces</th>
<th>Decreased circulating levels of albumin and cholesterol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interleukin – 1</td>
<td>Interleukin – 2</td>
<td>Interleukin – 6</td>
<td>Tumor necrosis factor</td>
</tr>
</tbody>
</table>

**General Recommendations**

Use your clinical judgment based on a thorough medical and nutritional assessment to make appropriate **individualized** recommendations.

Individualized care plan should focus on:

- improving and/or maintaining overall nutritional status
- acceptance of nutrition interventions
- clinical outcomes
Plan of Care for PU Treatment

UWL of >5% in 30 days, current wt. 140#, eats less than 50% of 2gm sodium diet, MNA screen 7 indicates malnutrition, Stage 3 PU on coccyx

Refer to registered dietitian or nutrition team to reassess, document malnutrition & implement treatment plan

General Recommendations: Nutrition Interventions for Pressure Injuries

Refer to registered dietitian or nutrition team to reassess, document malnutrition & implement treatment plan

General Recommendations: Nutrition Interventions for Pressure Injuries

Refer to registered dietitian or nutrition team to reassess, document malnutrition & implement treatment plan
**What Does the Evidence Suggest?**

**Energy Intake**

- Responsive increase in metabolic rate which increases caloric needs (triggered by PU, infection, severe illness, trauma, etc.)
- Energy is essential for pressure ulcer healing
- Need to provide adequate calories to promote anabolism, nitrogen and collagen synthesis
  - Creda 2011, Yamamoto 2009

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**What Does the Evidence Suggest for Optimal Protein**

- Increased protein linked to improved PU healing rates
- Based on metabolic changes & loss of muscle mass with aging protein 1.2-1.5g/kg BW is recommended

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**Lean Body Mass is Essential for:**

- Muscle Strength
- Immunity
- Skin Integrity
- Organ Function
- Wound Healing
**Loss of Lean Body Mass Counts**

<table>
<thead>
<tr>
<th>Loss of LBM</th>
<th>Complications</th>
<th>Associated Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>↓immunity, ↑infections</td>
<td>10%</td>
</tr>
<tr>
<td>20%</td>
<td>↓healing, weakness, infection</td>
<td>30%</td>
</tr>
<tr>
<td>30%</td>
<td>too weak to sit, pressure ulcers, pneumonia, no healing</td>
<td>50%</td>
</tr>
<tr>
<td>40%</td>
<td><strong>DEATH</strong>, usually from pneumonia</td>
<td>100%</td>
</tr>
</tbody>
</table>

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**The Non-healing Chronic Wound**

Failure to Heal by 12 Weeks:

- **The Non-healing Wound**
  - Catabolism
    - Energy
    - Protein Synthesis
  - Wound contraction

- **The Healing Wound**
  - Anabolism
    - Energy
    - Protein synthesis

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**Ensure Adequate Protein Intake**

15%-38% of older men eat less than the RDI for protein.

27%-41% of older women eat less than the RDI for protein.

What Does the Evidence Suggest for Optimal Protein Intake for Older Adults

- Protein spread equally between breakfast lunch and dinner (Paddon-Jones 2009)
- If needed, additional protein supplementation should be given between meals (Wilson MN 2002)

Protein Distribution

A. Optimal Protein Distribution
   - Breakfast: ~30 g protein
   - Lunch: ~30 g protein
   - Dinner: ~30 g protein

B. Skewed Protein Distribution
   - Maximum protein synthesis
   - Breakfast: ~10 g protein
   - Lunch: ~20 g protein
   - Dinner: ~60 g protein

Fluids: What Does the Evidence Suggest?

Dehydration is a risk factor for pressure ulcer development.
Hydration needs must be met to assure proper prevention and healing.
**Fluids**

Needs increase according to insensible water loss

Needs may decrease for CHF, renal failure

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**Consider TAPS**

- Turn
- Align
- Position
- Sips

1 mL/calorie consumed
30 mL/kg BW/day

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**Hydration Interventions**

- Add variety of beverages
- Glass of water with meals
- Hydration pass & juice machines with resident access
- Hydration in rehab department
What Does the Evidence Suggest?

Micronutrients

Vitamins and Minerals

- Provide/encourage an individual with a pressure ulcer to consume a balanced diet that includes good sources of vitamins and minerals. (SOE = B, SOR = Definitely do it)
- Provide/encourage an individual with a pressure ulcer to take vitamin and mineral supplements when dietary intake is poor or deficiencies are confirmed or suspected. (SOE = B, SOR = Probably do it)
Micronutrients

- Most nutrient needs can be met through a healthy diet
- Individuals with PUs may not be consuming an adequate diet
- No evidence to support vitamin C above the RDI unless a deficiency is diagnosed or suspected

Zinc

- No research to show zinc supplementation improves healing
- When clinical signs of zinc deficiency are present, zinc should be supplemented at <40 mg elemental zinc/day (UTL)
- Doses >40 mg/day can adversely affect copper status and possibly result in anemia

Plan of Care for PU Treatment

UWL of >5% in 30 days, current wt. 140#, eats less than 50% of 2gm sodium diet, MNA screen 7 indicates malnutrition, Stage 3 PU on coccyx

Re-assess, interview individual, assess calorie 20-35 kcal/kg ABW, protein 1.25-1.5 g/kg ABW, fluid 1 mL/cal, modify diet to reg, recommend multivitamins/minerals, offer high protein oral supplementation between meals

Refer to registered dietitian or nutrition team to reassess, document malnutrition & implement treatment plan
Obesity and Pressure Injuries

Obese Individuals

- There are no evidence based guidelines available related to the nutritional needs of the obese person with pressure injuries
- Adequate calories, protein, fluids and nutrients are needed for healing
  - General consensus is that diets should be liberalized to promote healing
  - Once the PrI is completely healed, diet restrictions may be gradually implemented as needed
- Monitor skin integrity and coordinate with RDN (ongoing)

Alternate Food Sources of Protein

<table>
<thead>
<tr>
<th>Item</th>
<th>Calories</th>
<th>Protein (gms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 oz. Greek yogurt</td>
<td>140 cal</td>
<td>14</td>
</tr>
<tr>
<td>Half sandwich 8 oz. 2% milk</td>
<td>320 cal</td>
<td>18</td>
</tr>
<tr>
<td>High protein bar</td>
<td>210 cal</td>
<td>12</td>
</tr>
</tbody>
</table>
Plan of Care for Chronic Non-healing PU

Slowing regaining wt., eats 75% of meals, 100% of supplement, stage IV PU on coccyx & no progress toward healing plus draining wound.

Re-assess, interview individual, continue parenteral calorie & protein levels. Fluid offered between meals, discontinue multivitamin/multimineral, offer high protein oral supplement fortified with arginine & micronutrients between meals.

CUBE Trial

A multi-country, randomized, placebo-controlled trial to demonstrate the efficacy of a specific ‘arg+ONS-spec.’ on pressure ulcer healing in non-malnourished patients with stage III-IV ulcers.

Ready-to-drink, high-protein, arginine enriched nutritional supplement

Containing per 200-ml serving:

- 20 g protein
- 3 g L-arginine
- 250 kcal
- Vitamins and micronutrients including:
  - 250 mg vitamin C
  - 38 mg vitamin E (α-TE)
  - 9 mg zinc
  - 1.5 mg carotenoids

Earlier Reduction in Ulcer Size from Baseline

With specific oral nutritional support a significant reduction in ulcer size was reached 2 weeks earlier compared to the control group.

- First time-point with a significant reduction compared to baseline
- Arg+ONS-spec. = day 21, P=0.011
- Control group = day 35, P= 0.019
- Means ± SEM; data adjusted for center
Oligo Element Trial Study Group

- Multicenter, RCT to evaluate supplementation with arginine, zinc & antioxidants in high-calorie, high-protein formula to improve PrU healing
- 200 malnourished patients with stage II,III,and IV PrUs
- 8 week trial – LTC and home care in Italy
- Majority of PrUs on sacrum


Malnourished criteria

- UWL – 5%(30 days) and 10% 3months
- BMI< 20 age <65 and < 21 > 65
- Food intake (<60% of estimated total daily energy requirements in the week before the study)
- Both groups received a 400 mL high-calorie, high-protein formula (100 Ml ,4x/day)
- Standard wound care for all

Nutritional Supplement in 100mL

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Standard: Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein 10 grams</td>
<td>Protein 10 grams</td>
</tr>
<tr>
<td>Arginine-L 1.5</td>
<td>Arginine-0</td>
</tr>
<tr>
<td>Zinc 4.5 mg</td>
<td>Zinc 2.3 mg.</td>
</tr>
<tr>
<td>Copper 675 mcg</td>
<td>Copper 338 mcg</td>
</tr>
<tr>
<td>Vitamin C 125 mg</td>
<td>Vitamin C 19mg</td>
</tr>
<tr>
<td>Vitamin E 19.0 mg</td>
<td>Vitamin E 2.3 mg</td>
</tr>
</tbody>
</table>
Conclusion

• 69.9% in intervention formula group had 40% or greater reduction in PU size compared to 54.1% in control
• The efficacy of these nutrients in wound healing is likely synergistic because there is no evidence supporting an independent effect when given alone
• This nutritional intervention may be beneficial when added to optimized local wound care for the treatment of pressure ulcers in malnourished patients.

Plan of Care for Chronic Non-healing PU

Nutrition Support

Consider nutritional support (enteral or parenteral nutrition) when oral intake is inadequate. This must be consistent with the individual’s goals. (Strength of Evidence = C, SOR= Probably do it)
### Nutrition Support

- NPO >3-5 days
- Hydration with IVs does not supply nutrients
- Places individual at risk of undernutrition and pressure injury development

### Enteral Feedings

Determine if patient actually receives TF as prescribed:
- Is TF given as ordered (product, mLs/hr)?
- Are flushes given as ordered (flushes, flushes with meds)?
- Is the strength correct?
- Is the individual tolerating the feeding?
- Round the clock or intermittent (turned off)?

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Function</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>Energy source to preserve lean body mass</td>
<td>30-35 kca/kg BW &amp; adjust per client, level of obesity</td>
</tr>
<tr>
<td>Protein</td>
<td>Tissue maintenance Collagen synthesis, build LBM</td>
<td>1.25-1.5 g/kg BW adjust per condition, monitor renal status</td>
</tr>
<tr>
<td>Fluid</td>
<td>Normal cell function &amp; tissue integrity</td>
<td>1 mL/kgal consumed, monitor hydration status</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>Collagen synthesis, supports formation of new blood vessels</td>
<td>Mega doses not recommended</td>
</tr>
<tr>
<td>Zinc</td>
<td>Protein synthesis; cellular growth; deficiency impairs healing</td>
<td>RDA 11mg/day males,8mg/day females, mega doses not recommended, UTR 40 mg/day</td>
</tr>
<tr>
<td>Arginine</td>
<td>Biological precursor to nitric oxide, increases blood flow which can support collagen in wounds</td>
<td>Supplemental arginine in kcal: 0 protein supplement with micronutrients maybe beneficial</td>
</tr>
</tbody>
</table>
Steps to Successful Nutrition Care

1. Screen and Assess Nutrition Status
   - Individualize interventions and develop POC

2. Provide diet based on estimated needs, consider fortified foods
   - Offer supplements between meals if intake is inadequate

3. Consider ONS fortified with arginine, vitamin or minerals if needs not met with high calorie/protein supplement
   - Consider EN/PN based on resident’s wishes, when needs cannot be met orally

Pressure Injury Care

Effective pressure injury treatment: multidisciplinary & holistic

Nursing Care
- Turning regimes, hygiene, etc.

Support Surfaces
- Mattresses, cushions, protection, etc.

Wound Care
- Dressings, cleaning, drainage, etc.

Nutrition
- Delivery of nutrients to stimulate healing

April 2015

The Role of Nutrition for Pressure Ulcer Management: National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, and Pan Pacific Pressure Injury Alliance White Paper

- Mary Ellen Posthauer, RDN, LD, FAND
  - President, MEP Healthcare Dietary Services, Inc., Evansville, IN

- Merilyn Banks, PhD, Director Nutrition and Dietetics, Royal Brisbane & Women’s Hospital Herston, Queensland, Australia

- Becky Dorner, RDN, LD, FAND
  - President, Becky Dorner & Associates, Inc., Naples, FL

- Jos M.G.A. Schols, MD, PhD
  - Professor of Old Age Psychiatry and Department of Health Services Research
  - Maastricht University, The Netherlands

Advances in Skin and Wound Care – The International Journal for Prevention and Healing
New 2014 NPUAP-EPUAP and Pan Pacific Injury Alliance Guidelines

- **Quick Reference Guide:** summary of the recommendations and excerpts of the supporting evidence for pressure ulcer prevention and treatment. Intended as a quick reference.
- **Clinical Practice Guideline:** comprehensive version of the guideline, a detailed analysis and discussion of available research, critical evaluations and description of the methodology used to develop guideline.

- www.npuap.org to order copies

References


