



We Treat Kids Better

# Nutrition For Pediatric Wound Healing

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# Objectives

- Understand the stages of wound healing and nutrients that impact the various phases
- Identify patient populations at risk for poor wound healing
- Develop/Demonstrate appropriate nutrition assessment/intervention/plan for pediatric patients with non healing wounds
- Distinguish when and how to supplement specific nutrients

## Wounds in Pediatric populations

- Complex wounds:
  - Pressure ulcers (II, III, IV)
  - Non-healing surgical incisions w/dehiscence
  - Open and/or infected wounds
  - Vacuum assisted closures (VACs)
- Prevalence Pressure ulcers:
  - Up to 27% in Pediatric intensive care units
  - Up to 23% in NICU
- Consequences/Impact:
  - Increased hospital LOS
  - Decreased QOL and comfort
  - Financial burdens: Annual cost of tx pressure ulcers in the US = \$11 Billion

# Trivia

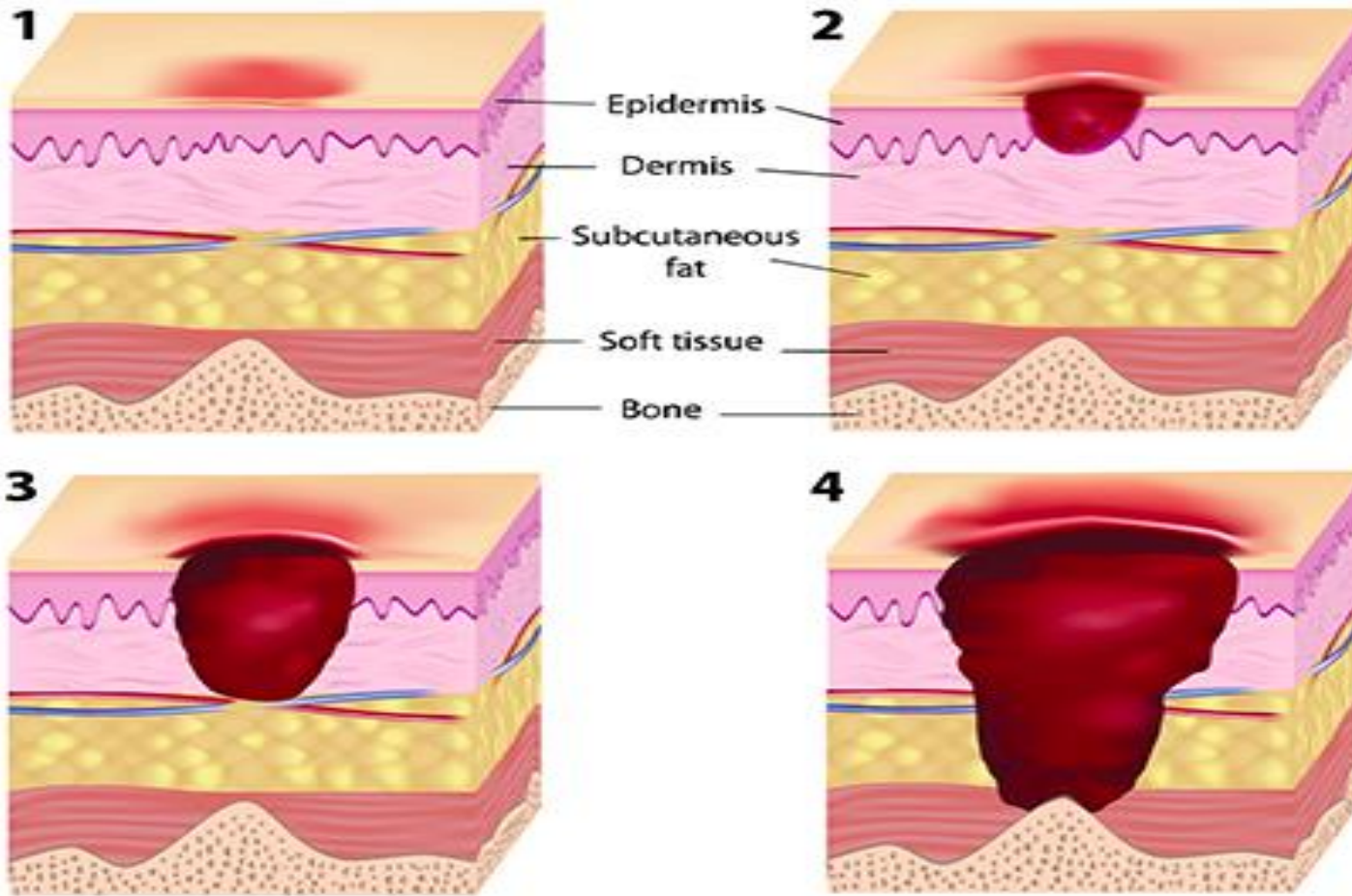
## Phases of wound healing?

- a) Inflammation, proliferation, hemostasis, remodeling
- b) Proliferation, granulation, remodeling
- c) Hemostasis, Inflammation, proliferation, remodeling

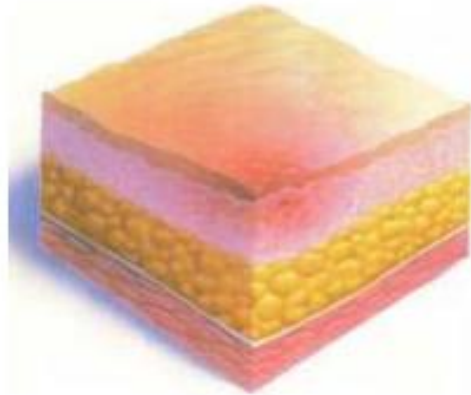
## Functions of the Skin?

- a) Protective, immunologic, social-interactive, Metabolic
- b) Thermoregulation, Neurosensory, fluid/electrolyte homeostasis
- c) Protective, immunologic, Neurosensory, fluid/electrolyte homeostasis
- d) Thermoregulation, Neurosensory, fluid/electrolyte homeostasis, Protective, immunologic, social-interactive, Metabolic

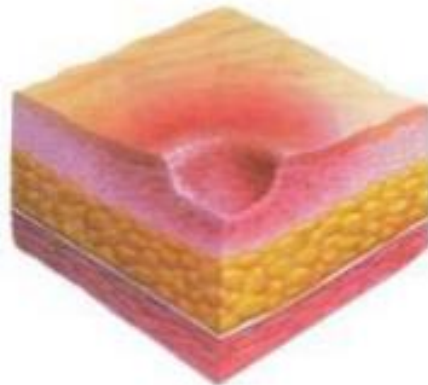
# Skin Layers: Pressure Ulcer Staging



## Stage 1

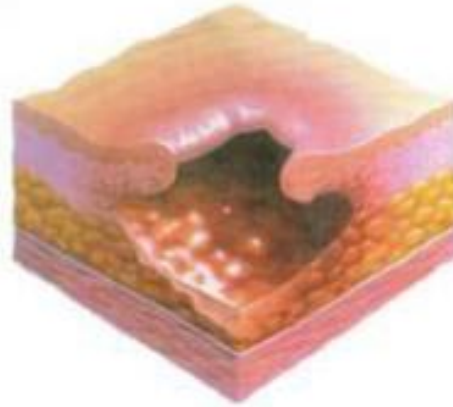


## Stage 2

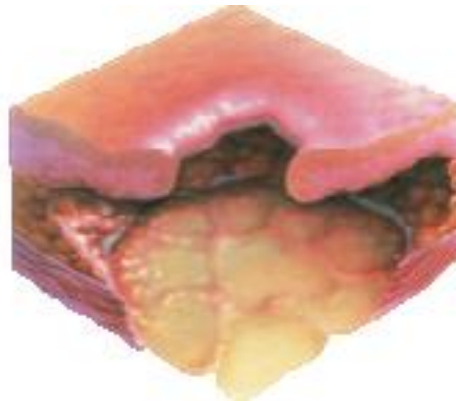




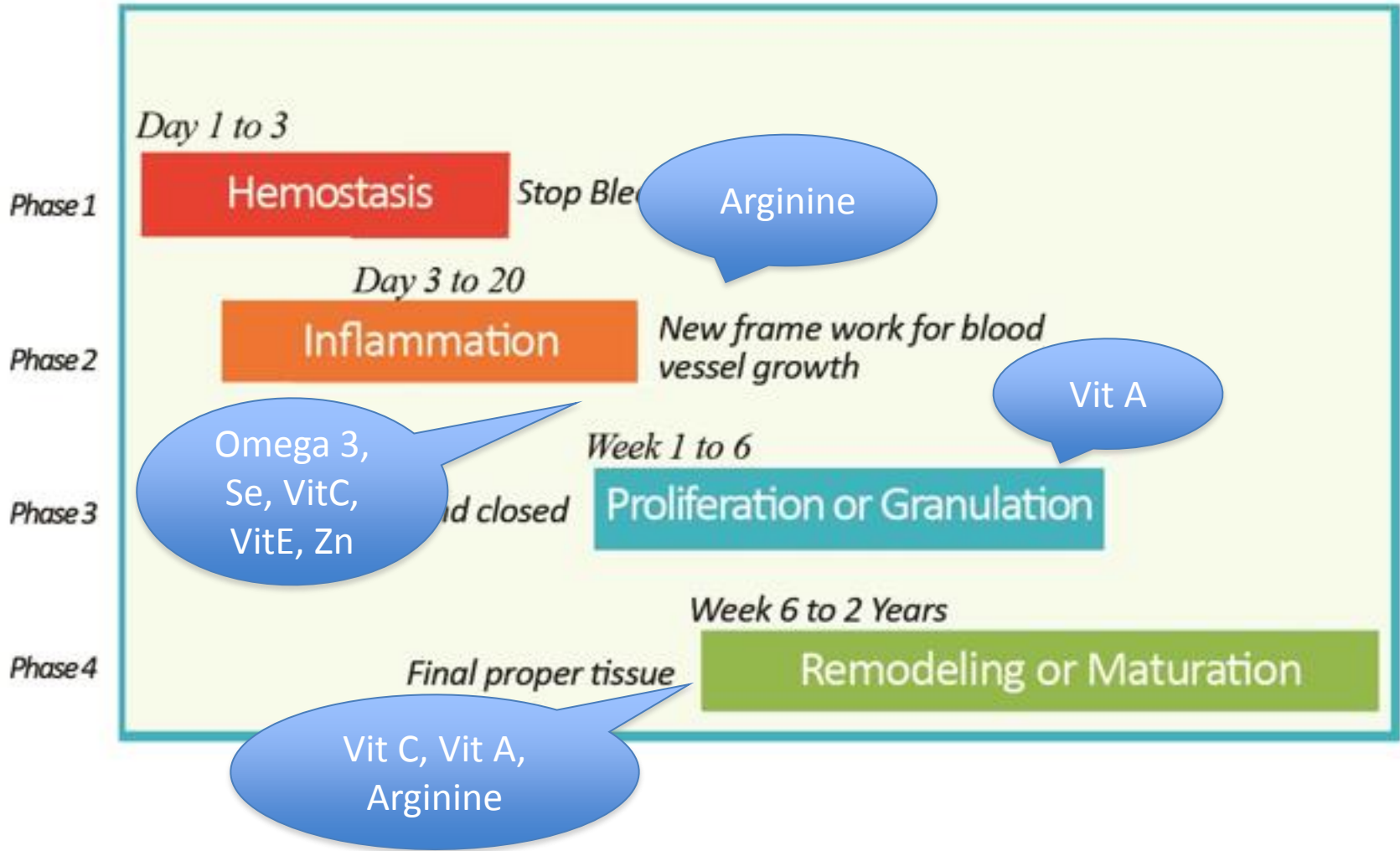
## Stage 3



## Stage 4



# Phases of Wound Healing





## RELATIONSHIP BETWEEN NUTRITIONAL STATUS, WOUNDS AND METABOLIC NEEDS

Increased requirements

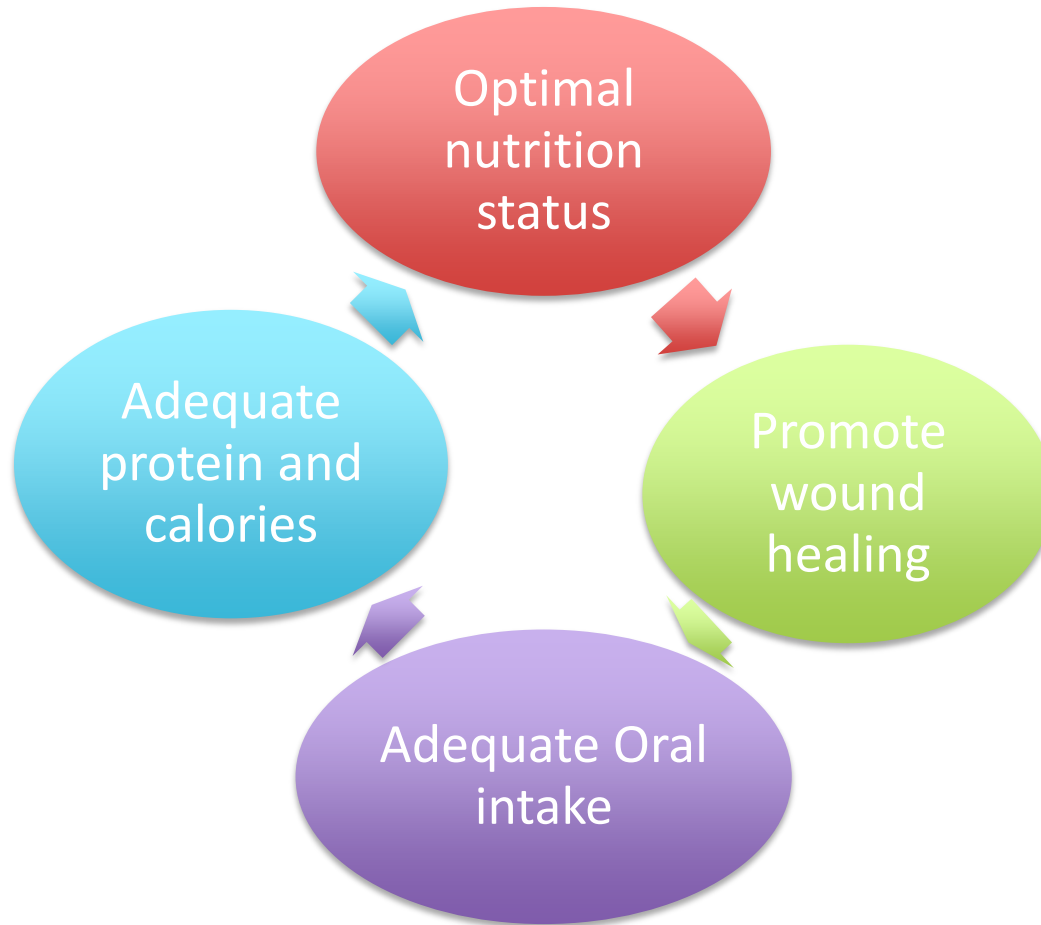
Malnutrition

Poor healing

Infection

LOS

# Nutrition Therapy Goals



# Nutrient functions in wound healing

Nutrient	Function
<b>Energy</b>	CHOs → principle energy source, helping to sustain high metabolic activity required for regeneration lipids/EFAs → energy for proliferation, building blocks for epidermal and dermal tissues
<b>Protein</b>	Collagen synthesis, epidermal growth, keratinization, scar formation, immune response, etc...
<b>Vitamin C</b>	Collagen synthesis, wound strength, electron donor for enzymes
<b>Zinc</b>	Protein synthesis, cellular growth/proliferation, deficiency impairs healing
<b>Vitamin A</b>	Promotes epithelial cell differentiation. Increases collagen cross-linkage. Suggested benefit in enhancement of early inflammatory phase.
<b>Arginine</b>	Semi essential AA- improves protein anabolism and cellular growth. Donor of NO which increases tissue blood flow.

# Comparative Standards/Nutrient Needs

Nutrient	Requirement
<b>Energy</b>	Increased based on assessed needs ( RDA, Schofield x Stress factor) *Ideal IC
<b>Protein</b>	Minimum 1.5 g/kg or 1.5-2 x RDA or per disease specific condition (Renal or liver failure)
<b>Vit C</b>	<p>5x RDA for age in 2 doses (250mg BID)</p> <p>Renal/kidney stones: no more than 2x RDA</p> Test Serum Vit C and start empiric supplementation while awaiting result. Continue supplementation only if deficiency is confirmed
<b>Zinc</b>	<p>2x RDA for age divided in 2 doses (elemental); 1-2mg/kg/d repletion</p> Test serum Zinc and start empiric supplementation while awaiting result. Continue supplementation only if deficiency is confirmed
<b>Vit A</b>	Supplementation suggested for chronic corticosteroid users, DM pts, those on chemo/radiation tx

- Adequate hydration is essential to wound healing → a warm, damp environment is ideal for the growth of new tissue
- Consequences of dehydration:
  - lack of moisture at the wound's surface will halt cellular development and migration
  - Decreased oxygen perfusion
  - Poor delivery of essential nutrients to wound surface
  - Evaluate for signs/symptoms of dehydration
    - Wt loss (in conjunction with -I/Os)
    - Skin turgor
    - Sunken fontanel
    - Dry mucosal membranes



## Labs: How to evaluate & what to look for/order?

- Optional: Albumin, Prealbumin
  - Alb and Prealb: Negative acute phase reactant → multifactorial
- Inflammatory Markers: WBC, Sed rate, Glucose, CRP
- If deficiency is suspected: Vit C, Zinc, Vit A (also may consider iron, Vitamin D, and copper levels)
  - May take > 7 days to result
- BUN/Cr (to monitor adequacy and tolerance of protein load)
  - Special considerations: pts prone to kidney stones or w/renal insufficiency (avoid Vit C >2x RDA and use Renal vit + supp Zn to avoid A toxicity)



# Immunonutrition?

**Glutamine:** utilized by immunologically active cells and those involved in wound repair

\*\*Supplementation has not been shown to benefit wound healing

**Arginine:** rapidly depleted during periods of severe stress; utilized in the synthesis of collagen (precursor to proline), thus increasing collagen deposition in wounds

OligoElement trial (2015), multicenter, randomized controlled, blinded trial

Supplemented w/energy dense, high protein, arginine, zinc, and antioxidant rich oral supplement (Cubitan, Nutricia)

**RESULTS:** Greater reduction in PU area (40% at 8 weeks)

\*No specific dosing guidelines for arginine currently exist



## Unit/Disease Specific Considerations

- Malnutrition is #1 !!! We all know this 😊
- Patients on long-term/chronic corticosteroids- induces inhibition of cutaneous wound healing → Rheumatoid arthritis, Lupus, Pulmonary diseases, UC/Crohns, Leukemia/Lymphomas, etc.
  - May require supplemental Vitamin A, dose/replete based on levels
- Immunocompromised patients: Heme/Onc, BMT, HIV/immune dz, premature infants, etc.
- Ortho/Surgical patients, particularly the CP kiddos needing pre-op nutrition assessments
- Hx of bowel resections and/or other possible malabsorptive conditions
- Diabetes- those with poor glycemic control

# Nutrition support

## What and when?

SCH protocol → 5% “dry” weight loss, BMI or Wt/Lt <10% or >95%, or <90% IBW, failure to grow

→ Starts MVI and offers oral supplement/shakes

→ If unable to tolerate PO, initiate EN/PN as indicated

## A word about products in the world of WOUNDS:

Arginaid and Arginaid Extra

Juven

Beneprotein, ProMod, ProStat

Boost HP, Boost Compact

Immunomodulating marketed formulas: Perative, Pivot, Impact, etc.



# Monitoring and Follow up

- Ideally:
  - Nutrition consult either on admit or upon discovery of wound
  - Reassessments q7 days→
    - including status of the wound (ex: TIME acronym for: Tissue characteristics, infection, moisture, and edges of the wound)
    - nutritional adequacy from PO/EN/PN
    - Labs + micronutrient supplements as indicated

# Take-home messages

- Research is still inconclusive regarding the use of Immunonutrition.
- Malnutrition = poor outcome/higher risk.
- Do not forget the limitation of common Nutritional markers.
- Multidisciplinary team work is essential.
- Increase LOS and Cost.
- It could be preventable.

# References

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# THANK YOU

## Any questions?