Special Article

[Simplified Wound Care/Management - Excerpts from 7th National Wound Care Workshop 2021]

Wound Care and Nutrition

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Optimal nutritional status helps achieve better wound healing outcomes. Proteins, amino acids, carbohydrates, vitamins and minerals are beneficial in wound recovery. Adequate water intake is necessary for perfusion and oxygenation of healthy and healing tissues. Nutritional assessment and enhancing nutrition with apt immunomodulating diets may eventually result in better clinical outcomes in wound healing. Certain non-essential immunonutrients may become conditionally essential for specific situation in wound healing Micronutrient supplements appear to reduce infections in patients with type 2 diabetes mellitus. Enteral nutrition helps to prevent degradation of lean body mass for gluconeogenesis and prevent malnutrition which is a risk factor for infectious complications.

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Key words **: Enteral nutrition, Immunomodulating diets, Micronutrient, Nutritional assessment, Wound care.**

Nutrition therapy needs to be considered by every surgeon for management of wound. Good nutrition will aid in speeding up the wound healing process. However, a non-healing wound places the patient at an increased risk of death. Nutritional deficiencies or malnutrition can have repercussions on wound healing by obstructing normal healing process through various mechanisms (Fig 1). Goals of providing a good nutrition in wound healing are summarized in Fig 2.

Calorie Requirement in Wound Healing :

Energy is required for several organ functions such as anabolism, nitrogen synthesis, collagen formation, and wound healing[1,2]. Moderator suggested to follow guidelines from American Society for Parenteral and Enteral Nutrition and the Wound Healing Society for management of patients with chronic wounds and required calories for optimal wound healing is approximately 30 to 35 kcal/kg/d[1,3,4]. According to National Pressure Ulcer Advisory Panel (NPUAP), to optimize wound healing in malnourished patients (who are underweight or are losing weight), it is recommended to increase their energy goals to 35 to 40 kcal/kg/d[1,3-5].

Editor's Comment :

- Nutritional assessment and enhancing nutrition with apt immuno-nutrients may eventually result in better clinical outcomes in terms of associated wound complications, duration of wound healing and treatment expenditure.
- In special populations such as patients with trauma or with upper gastrointestinal malignancies, who are highly susceptible to develop malnutrition or sepsis, IMDs can be most efficacious in healing process.

Nutritional Requirements during Wound Healing :

Generally, patients with trauma or chronic wound or who have undergone surgery experience an increase in the metabolic or energy demands. Current standard care includes providing enteral nutrition (EN) that will help to prevent degradation of lean body mass for gluconeogenesis and to prevent malnutrition, a risk factor for infectious complications. Table 1 summarizes the role of nutrients in wound healing.

Proteins : Severe protein depletion results in decreased skin and fascial wound breaking strength and increased wound infection rates. Increased protein intake is associated with enhanced wound healing rates. The recommended range of protein associated with healing is between 1.25 and 1.5 g/kg/d for individuals with chronic wounds. If the patients are severely catabolic, with more than one wound, or with a stage III or IV pressure ulcer, they may require 1.5 to 2 g/kg/d protein.

Amino Acids : Arginine and glutamine are the two vital amino acids that have shown to be beneficial in wound recovery. In case of acute wounds, arginine

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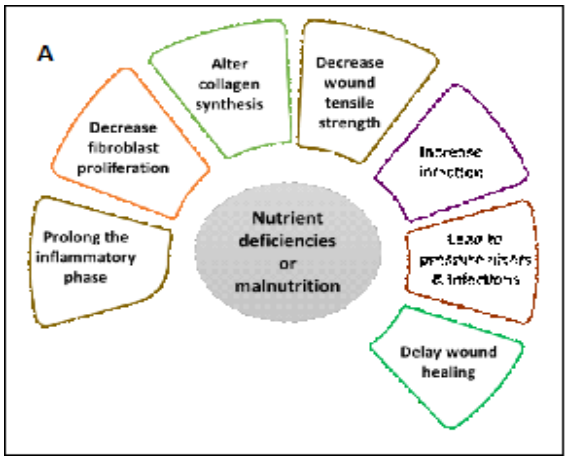

Fig 1 — Negative effects of nutritional deficiencies or malnutrition

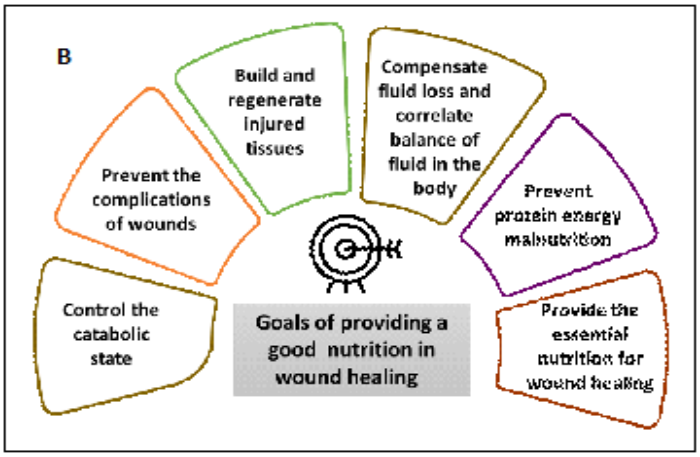

Fig 2 — Goals of providing a good nutrition in wound healing

supplementation has been shown to improve wound tensile strength. In cases of trauma if you suspect depletion of body stores, the nutritional supplementation with arginine is recommended for wound healing and the arginine-supplemented enteral formulas contain 12.5 to 18.7 g/L arginine. The oral arginine supplements used for benefit in wound healing contained between 17 and 30 g/d. Glutamine plays a role in lymphocyte proliferation and is important in stimulating the inflammatory response during the inflammatory phase of wound healing. It is recommended to provide supplemental glutamine at a dose of 0.57 g/kg/d for wound healing in adults. Moderator recommended amino acid supplementation for diabetic foot wounds. Supplementation with arginine, glutamine, and beta-hydroxy-beta-methylbutyrate (HMB) may aid in increased collagen production and thus, improve the wound healing process[6].

Vitamins and Minerals : These supplements appear to reduce infections in people with type 2 diabetes mellitus that are more prone to micronutrient deficiency.

Vitamin A[7] The recommended dose of vitamin A is 10,000-50,000 IU/d orally or 10,000 IU intramuscularly for 10 days in patients with injury. Moderator highlighted the importance of topical or systemic administration of vitamin A that will correct delay in wound healing in patients on long-term corticosteroid treatment. Oral administration of 10,000 to 15,000 IU/d is recommended to enhance wound healing in these patients.

Vitamin C : Recommended Vitamin C supplementation for:

- Stage I or II pressure ulcers: 100 to 200 mg/d orally until healing occurs
- Stage III or stage IV pressure ulcers or severe trauma: 1,000 to 2,000 mg/d orally until healing occurs

Role of Water in Wound Healing :

Adequate water intake is necessary for perfusion and oxygenation of healthy and healing tissues, prevention and treatment of skin breakdown, and improving efficacy in the treatment of chronic wounds. Recommendations for daily fluid intake are 30 mL/kg or 1 to 1.5 mL/kcal. Increased fluid demands exist in patients who are receiving a high protein intake, experiencing major fluid loss from wounds with high exudate or undergoing treatment with suction or Negative-pressure Wound Therapy (NPWT) devices, use of air-fluidized beds, and fluid losses from other causes.

Nutritional key aspects of Peri-operative Care (ESPEN guideline)[8]

- Integration of nutrition into the overall management of the patient
- Avoidance of long periods of preoperative fasting
- Re-establishment of oral feeding as early as possible after surgery
- Early start of nutritional therapy, as soon as a nutritional risk becomes apparent
- Metabolic control of blood glucose
- Reduction of factors which exacerbate stress-related catabolism or impair gastrointestinal function
- Minimize time on paralytic agents for ventilator management in the postoperative period
- Early mobilization to facilitate protein synthesis and muscle function

Panel Discussion :

Q. What nutritional precautions should be taken in patient with liver diseases in wound healing?

- Do not eat foods high in fat, sugar and salt.

Table 1 — *Nutritional requirements for wound healing*

Nutrient	Recommended Dietary Allowance (RDA)	Role
Proteins	0.8 g/kg body weight	Cell mitosis and migration; immune system responses; synthesis and secretion of intracellular and extracellular proteins, especially collagen; synthesis and secretion of growth factors; formation of connective tissue
Carbohydrates	225-325 g/d	Provision of ATP for all cellular activity
Vitamin C	2.0 mg/d	Collagen synthesis; cell mitosis and migration; immune system function (fibroblast proliferation, capillary formation, and neutrophil activity)
Vitamin A and vitamin B	3.33 IU (vitamin A)	Strengthening and maturation of collagen
Nicotinamide	16.0 mg NE for men 14.0 mg NE for women	■ Possess anti-inflammatory, antioxidative properties ■ Enhances the healing by induction of collagen bundle synthesis, fibroblast proliferation, and revascularization
Pantothenic Acid	5.0 mg	■ Enhances both collagen synthesis and collagen cross-linking ■ Promotes cellular multiplication during initial wound healing
Zinc	11.0 mg/d for men 8.0 mg/d for women	Cell mitosis; protein synthesis; strengthening and maturation of collagen
Copper	1.7 mg	■ Cofactor for connective tissue production ■ Collagen cross-linking
Manganese	4.0 mg	Collagen and ground substance synthesis
Grape seed extract	-	Potentiated oxidant-induced VEGF expression in human keratinocytes and support repair process.
Protein hydrolysates	-	■ Protein hydrolysates provide a rich source of protein which is useful during repair of tissue damage. ■ The consumption of protein hydrolysates has been shown to result in more rapid uptake of amino acids compared with whole proteins or free-form amino acid mixtures and some peptides in hydrolysates exhibit biological activity.

Stay away from fried foods including fast food restaurant meals. Raw or undercooked shellfish such as oysters and clams are a definite no-no. Prefer eating a balanced diet including foods from all food groups

■ Consult with your doctor about alcohol and your liver health. Depending on the state of your liver, you should avoid alcohol. If you are allowed alcohol, limit it to no more than one drink a day if you are a woman and two drinks a day if you are a man.

■ Fiber-rich food (Fruits, vegetables, whole grain breads, rice and cereals) should be included in your diet that will help your liver work at an optimal level.

■ Adequate water intake prevents dehydration and it helps your liver to function better.

Q. What should be the nutritional perspective to achieve wound healing in obese patients?

■ Choose vegetables and fruits rich in vitamin C, such as strawberries or spinach.

■ Some wounds may require a higher intake of certain vitamins (vitamin A and C) and minerals (zinc, manganese, copper) to support healing.

■ Carbohydrates rich foods are also suggested which provides energy for all cellular activities during different phases of wound healing.

Q. What dietary precautions should be taken for wound healing in patients on dialysis?

■ Chronic kidney disease diet involves general principles: Each patient requires an individualized diet prescription based on the stage of the disease and the patient's weight, symptoms, activity level, other medical problems and goals.

■ The general diet focuses on: limiting fluids; eating a low-protein diet; restricting sodium, potassium, phosphorous and other electrolytes; and getting enough calories if unintended weight loss is a problem.

■ The expertise of a registered dietician specializing in renal disease is necessary to individualize the diet to each patient's unique medical situation.

Q. What is the role of Vitamin D / Vitamin E in wound healing?

■ When the skin is injured, a higher amount of vitamin D intake will enhance healing and better outcomes. Additionally, vitamin D promotes the formation of cathelicidin, an antimicrobial peptide that is used by our immune system to fight off wound infections.

■ Vitamin E is recommended in cases of wounds infected with methicillin-resistant Staphylococcus aureus (MRSA), as it modulates cellular signaling, gene expression and acts against MRSA infection.

Q. Which nutritional supplements can be given for wound healing in pregnancy?

■ Nutrients that have been shown to enhance the healing process include vitamin C, vitamin E, zinc, and two important amino acids, arginine and glutamine. Research has shown that arginine, vitamin C, and zinc may be among the most important nutrients to promote wound healing.

Q. What is the role of immune nutrition (immunomodulating diets [IMD])?

■ Immunomodulating diets help the immune system in several ways: working as an antioxidant to protect healthy cells, supporting growth and activity of immune cells, and producing antibodies.

■ Diet rich in vitamins and minerals will help to achieve better wound healing outcomes. Without a good nutritional support, wound will never heal.

■ Essential role of Arginine has been recently discussed for trauma patient or patients at high risk for malnutrition

■ Supplementation with arginine, glutamine, omega-3 fatty acids, vitamins, and trace minerals has been associated with decreased infection complications and improved healing

■ Immune nutrition's are playing pivotal role as per emerging literatures on clinical outcomes such as ventilator times, hospital stays, rates of infection, and mortality[9]

■ REDOXS & GLINT trial are aimed at showing specific clinical outcome differences in the manipulation of levels of specific immunonutrients rather than an entire formula

■ Pharmaconutrition is a new focus on the effects of high doses of key nutrients as opposed to providing broader and higher volumes of supplementation

■ The precise mode of action and/or efficacy is evolving amongst the key components of commonly used immunomodulating formulas.

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