

# 359 Recent Major Surgery, Physical Trauma, Burns

## Definition/Cut-off Value

Major surgery (including cesarean sections), physical trauma or burns severe enough to compromise nutritional status.

Any occurrence:

- Within the past two ( $\leq 2$ ) months may be self-reported.
- More than two ( $> 2$ ) months previous must have the continued need for nutritional support diagnosed by a physician or a health care provider working under the orders of a physician.

## Participant Category and Priority Level

Category	Priority
Pregnant Women	I
Breastfeeding Women	I
Non-Breastfeeding Women	III, IV, V or VI
Infants	I
Children	III

## Justification

The body's response to injuries such as major surgeries, physical trauma, or burn may adversely affect nutrient requirements needed for recovery, leading to malnutrition. The catabolic response to these injuries causes a hypermetabolic state in the body. This alteration in metabolism not only increases the individual's calorie and protein needs, but they also increase the needs for certain vitamins, minerals, fatty acids, and amino acids. (1)

Proper wound healing is essential in the recovery of surgeries, physical trauma, and burns. Normal wound healing is a complex process and involves three phases: inflammation, proliferation, and remodeling (1, 2). Each phase of wound healing involves growth factors, other biologically active molecules, and specific vitamins and minerals such as Vitamin A, Vitamin C, and Zinc. The process of wound healing does not always follow the three stages sequentially and can sometimes move forward or regress based on nutrition status and response to treatment (3, 4). Even after a wound is closed, the individual's metabolic rate and need for additional nutrition can remain high (5).

Factors that can prevent proper wound healing or can increase the time needed for a wound to heal include (2, 6):

- Malnutrition prior to the surgery, injury or burn
- Infections
- Diabetes

- Poor blood flow
- Obesity
- Age
- Heavy alcohol use
- Stress
- Medications
- Smoking

Because healing is a complex process and is impacted by a variety of factors, it is inappropriate to expect a set recovery time for an individual based solely on the type and severity of the injury (7). For some individuals, they may no longer be at increased nutritional risk within a couple weeks of their injury. For others, recovery from the same type and severity of injury may take months.

### **Major Surgery and Wound Healing**

Many types of surgeries are completed as noninvasive procedures and do not result in large incisions that require additional medical and nutritional care to heal. However, many surgical procedures (including cesarean sections) do involve incisions that, if left unaddressed, could lead to infection. Major surgeries are surgeries that involve a risk to the life of the individual and include operations on organs within the body (8). Removal of a portion of the large or small intestine, heart surgery, and bariatric surgery are examples of major surgeries. Minor surgeries are surgeries that involve little risk to the individual and include operations on the superficial structures of the body (9). Ear tubes, the most common childhood surgery performed with anesthesia, are an example of a minor surgery that does not impact nutrition status (10).

Cesarean sections are considered a major surgery and, therefore, require additional assessment and education in the WIC clinic. In the US, the rate of cesarean delivery rose from 19.7% of singleton births in 1996 to 31.3% of singleton births in 2011 (11). Reasons for a cesarean delivery include: multiple pregnancy, labor fails to progress, medical concerns for the infant, problems with the placenta, a large infant, breech position, maternal infections, and medical conditions in the mother (i.e. diabetes or high blood pressure) (12).

### **Nutritional Considerations for Major Surgery/Wound Healing**

The role of specific nutrients in wound healing continues to be explored and studies are conducted regularly to assess the role vitamins, minerals, fatty acids, amino acids, and carbohydrates play in proper wound healing. Nutrient supplements above the Recommended Dietary Allowance (RDA) may be necessary to aid in wound healing. However, before using any additional supplement to assist in wound healing, energy and protein requirements of the individual must be met (13, 14). Amino acids are essential to the repair of damaged tissue in the body. Amino acids are divided into three categories: essential (must be obtained through foods), nonessential (can be produced in the body), and conditionally essential (produced in the body except in cases of injury or illness). Arginine and Glutamine are examples of conditionally essential amino acids. The following table highlights the roles of these nutrients in the wound healing process:

Nutrient	Role in Wound Healing
Arginine	Involved in secretion of growth hormone (12)
Omega-3 fatty acids	Reduces wound infections (12)
Vitamin C	Collagen synthesis (2)
Vitamin A	Immune function and cellular communication (15)
Vitamin E	Antioxidant (16)
Vitamin D	Modulates cell growth Neuromuscular and immune function Reduces inflammation (17)
Magnesium	Co-factor for enzymes involved in protein and collagen synthesis (2)
Copper	Co-factor for cross-linking of collagen (2)
Zinc	Involved in RNA and DNA polymerase (2)
Iron	Aids in the synthesis of some growth hormones and connective tissue (18)

Following a cesarean section, a breastfeeding mother may experience difficulty finding a comfortable nursing position that does not cause pain with the incision. She may also have difficulty breastfeeding if the infant is drowsy due to the pain medication administered during the procedure. A referral to a lactation specialist can help ensure that the mother is successful in reaching her breastfeeding goals.

### Physical Trauma

Physical trauma is usually a result of accidents and injuries that often lead to fractures, wounds, and subsequent hospitalization. Physical trauma can be divided into blunt force trauma, penetrating trauma, and trauma from surgery. Blunt force trauma is the result of an object (or force) striking the body, causing concussions, lacerations or fractures. Penetrating trauma is trauma that occurs as a result of an object piercing the skin, causing an open wound (7). Fracture healing is a process that begins with a hemorrhage and progresses through three stages: inflammatory, reparative, and remodeling.

Physical trauma can also be a result of domestic and/or child abuse. In addition to the physical effects of abuse, victims of abuse often experience acute and ongoing psychological and emotional trauma that may also impact an individual's nutrition status. Poor appetite, undesirable food choices, and using food for coping can impact both women and children. Children may also begin hoarding food in cases of abuse or neglect. For more information on the impact of abuse, see Risk #901 *Recipient of Abuse*.

### Nutritional Considerations for Physical Trauma

In addition to an increase in energy, protein, and micronutrients needed for proper wound healing, physical trauma that includes fractures requires additional nutrients for proper bone healing. In some cases, the physical trauma will lead to temporary or lifelong difficulty with self-feeding. Research on the roles specific nutrients play in fracture healing continues to expand. Key nutrients for bone health include calcium, phosphorus, fluoride, magnesium, sodium, vitamin D, vitamin A, vitamin K, vitamin C, vitamin B6, folate, and vitamin B12. Meeting RDAs set for these nutrients is important for bone health and bone healing (19).

For some individuals, intakes above the RDA may be recommended by their medical provider to assist in bone healing; however, some nutrients including fluoride, sodium, and vitamin A may negatively impact bone health when intake is above the recommended level (19).

### **Burns**

Burns can be caused by heat (including hot surfaces, fires, and hot liquids), chemicals, electricity, sunlight or nuclear radiation. There are three stages of burns based on what layers of the skin are burned. A first-degree burn only affects the outer layer of the skin (epidermis). A second-degree burn damages the epidermis and the layer directly under the epidermis (dermis). A third-degree burn damages the epidermis, dermis, and damages the tissue underneath the skin. (20)

Burns are also classified based on the surface area of the body that has been burned (Percent Total Body Surface Area or TBSA). For example, a burn that covers one hand and arm would be 9% TBSA, whereas a burn that covers a person's back would be 18% TBSA (21). Increases in the surface area affected by the burn result in a greater potential for fluid loss and infection (21). Inhalation burns are burns that occur inside an individual's lungs and internal organs. Once discharged from the hospital, enteral feedings may be prescribed to aid in healing.

### **Nutritional Considerations for Burns**

The nutrition status of burn patients is monitored very closely during hospitalization and after discharge. Following a severe burn, the body goes into a catabolic state and the body begins to breakdown skeletal muscle (5). This state increases the requirements for energy, protein, carbohydrates, fats, vitamins, minerals, and antioxidants (22). Damaged blood vessels also increase fluid loss and can lead to dehydration or shock (19). Nutrition care in the hospital setting for individual's recovering from burns may also include parenteral or enteral nutrition support depending on the severity of the burns. Glutamine, a conditionally essential amino acid, can improve the healing of burns (23).

### **Implications for WIC Nutrition Services**

Most surgeries, physical traumas, and burns are unexpected. The education and supplemental food that WIC provides can help ensure that the individual is in good nutritional health prior to the surgery, physical trauma or burn. Following a major surgery, physical trauma, and/or burn, an individual will be at increased nutritional risk until the injury has completely healed. WIC staff can improve outcomes following an injury by:

- Assuring that vitamin and mineral intakes meet the RDAs (unless amounts that exceed the RDAs are recommended by their medical provider).
- Assuring that energy and protein intake preserve lean muscle mass and body weight.
- Recommending a participant speak with their medical provider about a multivitamin supplement when diet alone cannot meet the RDAs for vitamins and minerals.
- Referring to community resources for smoking cessation, support groups, food assistance, and safe living environments (in cases of physical abuse).
- Referring to a lactation educator if women experience difficulty breastfeeding following a cesarean section.

## References

1. Gurtner GC. Wound Healing: normal and abnormal. In: Thorne CH, editor. *Grabb and Smith's Plastic Surgery*. Riverwoods, IL;2007. p.15-22.
2. Guo S, DiPietro LA. Factors affecting wound healing. *J Dent Res*. 2010; 89:219-229.
3. Wild T, Rahbarnia A, Kellner M, Sobotka L, Eberlein T. Basics in nutrition and wound healing. *J Nut*. 2010;26:862-866.
4. Stechmiller JK. Understanding the role of nutrition and wound healing. *Nutr Clin Pract*. 2010;25:61-68.
5. Prelack K, Dylewski M, Sheridan RL. Practical guidelines for nutritional management of burn injury and recovery. *J Burns*.2007;33:14-24.
6. National Institutes of Health [Internet]. Maryland; c1997-2015 [updated 2015 Jun 15; cited 2015 Jul 6]. How wounds heal; [about 3 screens]. Available from: <https://www.nlm.nih.gov/medlineplus/ency/patientinstructions/000741.htm>.
7. National Institutes of Health [Internet]. Maryland: [updated 2014 Nov 17; cited 2015 Aug 4]. Trauma Fact Sheet; [about 2 screens]. Available from: [http://nigms.nih.gov/Education/Pages/Factsheet\\_Trauma.aspx](http://nigms.nih.gov/Education/Pages/Factsheet_Trauma.aspx).
8. Merriam-Webster Medical Dictionary. [cited 2015 Jul 6]. Available from: <http://www.merriam-webster.com/medical/major+surgery>.
9. Merriam-Webster Medical Dictionary. [cited 2015 Jul 6]. Available from: <http://www.merriam-webster.com/medical/minor+surgery>.
10. American Academy of Otolaryngology-Head and Neck Surgery [Internet]. Virginia; c2015 [cited 2015 Aug 12]. Ear Tubes; [about 5 screens]. Available from: <http://www.entnet.org/content/ear-tubes>.
11. Osterman MJK, Martin JA. Changes in cesarean delivery rates by gestational age: United States, 1996-2011. *NCHS Data Brief*. 2013;124.
12. National Institutes of Health [Internet]. Maryland: [updated 2012 Nov 30; cited 2015 Jul 6]. When is a cesarean delivery necessary and what are the risks; [about 1 screen]. Available from: <http://www.nichd.nih.gov/health/topics/obstetrics/conditioninfo/pages/risks.aspx>.
13. Alexander JW, Supp D. Role of arginine and omega-3 fatty acids in wound healing and infection. *Adv Wound Care*. 2014;3:682-690.
14. Ellinger S, Stehle P. Efficacy of vitamin supplementation in situations with wound healing disorders: results from clinical intervention studies. *Curr Opin Clin Nutr Metab Care*. 2009;12:588-95.
15. National Institutes of Health [Internet]. Maryland: [updated 2013 Jun 5; cited 2015 Jul 6]. Vitamin A fact sheet for health professionals; [about 16 screens]. Available from: <https://ods.od.nih.gov/factsheets/VitaminA-HealthProfessional/>.
16. National Institutes of Health [Internet]. Maryland: [updated 2013 Jun 5; cited 2015 Jul 6]. Vitamin E fact sheet for health professionals; [about 11 screens]. Available from: <https://ods.od.nih.gov/factsheets/VitaminE-HealthProfessional/>.

17. National Institutes of Health [Internet]. Maryland: [updated 2014 Nov 10; cited 2015 Jul 6]. Vitamin D fact sheet for health professionals; [about 9 screens]. Available from: <https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/>.
18. National Institutes of Health [Internet]. Maryland: [updated 2015 Feb 19; cited 2015 Jul 6]. Iron fact sheet for health professionals; [about 20 screens]. Available from: <https://ods.od.nih.gov/factsheets/Iron-HealthProfessional/>.
19. Angelo G (Oregon State University, Linus Pauling Institute, Corvallis, OR). Micronutrient Information Center; 2012 Aug.
20. National Institutes of Health [Internet]. Maryland: [updated 2014 Aug 8; cited 2015 May 12]. Burns Fact Sheet; [about 2 screens]. Available from: [http://nigms.nih.gov/Education/Pages/Factsheet\\_Burns.aspx](http://nigms.nih.gov/Education/Pages/Factsheet_Burns.aspx).
21. National Institutes of Health [Internet]. Maryland: [updated 2011 Jun 25; cited 2015 Jul 6]. Burn triage and treatment – thermal injuries [about 11 screens]. Available from: <http://chemm.nlm.nih.gov/burns.htm>.
22. Chan MM, Chan GM. Nutritional therapy for burns in children and adults. *J Nut.* 2009;25:261-269.
23. Ellinger S. Micronutrients, arginine, and glutamine: does supplementation provide an efficient tool for prevention and treatment of different kinds of wounds. *Adv Wound Care.* 2014;3:691-707.

**Additional Reference:**

Mahan LK, Raymond JL. *Krause's food & nutrition care process.* 14<sup>th</sup> ed. Philadelphia (PA): Elsevier BV; 2016.