HOW DOES NUTRITION IMPROVE RADIOTHERAPY OUTCOMES?

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Objectives

• Discuss the role of nutrition during radiation treatment and how malnutrition alters the ability to tolerate radiation therapy
• Be able to discuss GI specific side-effects of radiation therapy and the nutrition management of these side-effects
• In what patient populations are prophylactic feeding tubes beneficial when undergoing radiation therapy
• Delineate the role of plant based/inflammatory diets in managing treatment side effects
• List benefits of arginine and glutamine in managing radiation therapy side-effects
• Explain risk-benefits for use of antioxidants in radiation therapy
Disclosure

- We have no conflicts of interest to report.
Why is nutrition important?

• Prevents muscle wasting and weight loss
• Improves management of side effects
• Less trips to EC for hydration
• Avoid missing treatments
• Improved quality of life and performance status
• Less fatigue
• Shortened recovery time post treatment
• Decreases infections, morbidity, and mortality

“Let food be thy medicine and medicine be thy food.”

-Hippocrates
Cancer-Related Metabolic Changes

- Alteration of enzyme activity and immune system
- Changes in energy expenditure and basal metabolism
- Changes in carbohydrate, lipid, protein metabolism
- Depletion of fat, protein, water, and mineral stores
- Cachexia
Nutrition Assessment

- Diet history
- Energy and protein intake
- Changes in food and fluid/beverage intake
- Adequacy and appropriateness of nutrient intake or nutrient administration
- Intake from enteral nutrition
- Changes in type, texture, or temperature of food and liquids
- Use of fortified nutrition beverages
- Food avoidance and intolerances
- Meal or snack pattern changes
- Factors affecting access to food
- Medical history
- Labs
- Medications
- Anthropometrics
- Nutrition Impact Symptoms (NIS)
- Functional capacity
- Nutrition focused physical exam
Nutrition Impact Symptoms

- Anorexia and early satiety
- Constipation
- Diarrhea
- Gas
- Nausea and vomiting
- Mucositis and esophagitis
- Dysphagia
- Dysgeusia and ageusia
- Xerostomia and excessive thick secretions
- Weight loss
- Malabsorption
- Fatigue
Managing Side Effects

- **Mucositis/Esophagitis**
  - Choose soft, moist foods
  - Avoid rough textures, acidic, tart, spicy foods
  - Cut foods into small bites and chew well
  - Puree foods in a blender adding milk or broth
  - Add non-acidic sauces and gravies to foods
  - Avoid temperature extremes
  - Drink adequate amounts of fluids
  - Practice good oral hygiene
  - Speak with medical team regarding medications
Managing Side Effects

• **Changes in Taste and Smell**
  - Good mouth care
  - Metallic taste- use plastic utensils, avoid canned foods
  - Salty/Bitter taste- combat with sweet flavors
  - Sweet taste- increase salty and tart flavors
  - Add seasonings such as basil, oregano, mint, rosemary, tarragon, onion, garlic, BBQ sauce, chili powder, ketchup, mustard
  - Marinate and cook meats in sweet juices, fruits, acidic dressings or wines
  - If unable to eat meat, include other protein foods
  - Clear taste buds with sugar-free gum, peppermints, pickles, lemon drops, lemon/lime sorbet, frozen fresh fruits (melon, grapes, oranges)
  - Zinc
  - “Tincture of time”
Managing Side Effects

- **Nausea/Vomiting:**
  - Nausea medication 30 minutes before meals
  - Small frequent meals/snacks to keep something on your stomach
  - Avoid favorite foods
  - Avoid greasy or spicy foods; foods with strong smells; cold/bland foods may be best
  - Suck on lemon drops, mints, ginger candy, tart foods
  - Fluids between meals; use cup with lid and straw if smells trigger nausea
  - Clear liquids: soup, broth, gelatin, lemonade, popsicles, tea, ginger ale
Managing Side Effects

• **Diarrhea**
  • Increase fluid intake
  • Electrolytes lost with diarrhea; increase consumption of high potassium and sodium foods/fluids
  • Small frequent meals
  • Limit high fiber foods
  • Limit high fat foods
  • Avoid alcohol, caffeine, spicy foods, hot liquids
  • Avoid hot fluids
  • Limit or avoid dairy foods if these make diarrhea worse
  • Limit sugar-free foods/fluids that contain sugar-alcohols
  • Take antidiarrheal medications as prescribed
Managing Side Effects

• **Constipation**
  • Gradually add fiber
  • Increase fluid intake
  • Prune juice followed by large glass warm water
  • Hot beverages
  • Regular moderate exercise (as tolerated)
  • Consider stool softeners and laxatives
  • Probiotics
Malnutrition

- The Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition (ASPEN) recommends classification of adult malnutrition by etiology:
  - Starvation-related malnutrition
  - Chronic disease-related malnutrition
  - Acute disease or injury-related malnutrition
- Additionally, they recommend that two or more of the following six characteristics would be needed for diagnosis of malnutrition:
  - Insufficient energy (caloric) intake
  - Weight loss
  - Loss of muscle mass*
  - Loss of subcutaneous fat*
  - Localized or generalized fluid accumulation that may mask weight loss*
  - Diminished functional status as measured by hand grip strength

*NFPA used to assess
Malnutrition

- Contributes to increased morbidity and mortality
- Decreased function and quality of life
- Increased frequency and length of hospital stay
- Higher healthcare costs
- Poor wound healing
Figure 1

CANCER-RELATED MALNUTRITION

Increased infection rate  Increased risk of postoperative complications  Reduced tolerance/response to chemotherapy or radiotherapy

Increased cost  Reduced performance status  Social burden

DECREASED QUALITY of LIFE
Nutrition Focused Physical Assessment

- Head to Toe Assessment
- Subcutaneous Fat Loss
  - Orbital region
  - Upper arm region
  - Thoracic and Lumbar region
Nutrition Focused Physical Assessment

• Subcutaneous Muscle Loss
  • Temple region
  • Clavicle bone region
  • Clavicle and Acromion bone region
  • Scapular bone region
  • Dorsal hand
  • Patellar region
  • Anterior thigh region
  • Posterior calf region
Feeding Tubes

- Multiple types – PFG, PEG, NGT/DHT, J-tube, G-J tube
- May be placed prophylactically or reactively
- Pros
  - Patients able to meet nutrition and hydration goals
  - Administer medications
  - Decreases weight loss
  - Fewer treatment interruptions
  - Improved QOL
- Cons
  - Infection/Bacterial contamination
  - Aspiration
  - Dependence
Prophylactic Feeding Tubes


• Severe weight loss prior to treatment (5% in 1 month, 10% in 6 months)
• Ongoing dehydration or dysphagia, anorexia, or pain interfering with the ability to eat/drink adequately
• Significant comorbidities that may be aggravated by poor tolerance of dehydration, lack of caloric intake, or difficulty swallowing necessary medications
• Severe aspiration, or mild aspiration in elderly patients who have compromised cardiopulmonary function
• Patients for whom long-term swallowing dysfunction is likely, including those anticipated to receive large fields of high-dose radiation to the mucosa and adjacent connective tissues
AICR Nutrition Recommendations

- **Weight**
  - Aim to be a healthy weight throughout life
  - Be physically active every day for 30 minutes or more
  - Choose mostly plant foods; limit red and processed meat

- **Cancer Prevention**
  - Avoid processed meat

- **Diet**
  - Be as lean as possible within the normal range of body weight
  - Be physically active as part of everyday life

- **Physical Activity**
  - Limit intake of red meat and avoid processed meat
  - Limit consumption of salt
  - Avoid mouldy cereals (grains) or pulses (legumes)

- **Recommendations**
  - **Body Fatness**
    - Be as lean as possible within the normal range of body weight
  - **Physical Activity**
    - Be physically active as part of everyday life
  - **Foods and Drinks That Promote Weight Gain**
    - Limit consumption of energy-dense foods
    - Avoid sugary drinks
  - **Plant Foods**
    - Eat mostly foods of plant origin
  - **Animal Foods**
    - Limit intake of red meat and avoid processed meat
  - **Alcoholic Drinks**
    - Limit alcoholic drinks
  - **Preservation, Processing, Preparation**
    - Limit consumption of salt
    - Avoid mouldy cereals (grains) or pulses (legumes)
  - **Dietary Supplements**
    - Aim to meet nutritional needs through diet alone
  - **Breastfeeding**
    - Mothers to breastfeed; children to be breastfed
  - **Cancer Survivors**
    - Follow the recommendations for cancer prevention

Source: [www.dietandcancerreport.org](http://www.dietandcancerreport.org)
AICR Dietary/Lifestyle Goals

• **Plant Based Diet**
  • 2/3 Plant Foods
    • Choose colorful produce
  • 1/3 Animal Protein
    • Incorporate meatless meals several times a week
    • Avoid eating processed meats such as cold cuts, bacon, sausage, and ham
    • WHO statement on processed meats

• **Physical Activity/Exercise** – work to have 30 minutes of moderate activity daily

• **Alcohol** – despite evidence of a heart protective effect with moderate alcohol consumption, there is not a similar effect with cancer. AICR recommends avoiding even small amounts of alcohol
AICR New American Plate

The New American Plate

\[ \frac{2}{3} \ (\text{or more}) \text{ vegetables, fruits, whole grains and beans}\]

\[ \frac{1}{3} \ (\text{or less}) \text{ animal protein}\]

American Institute for Cancer Research
Nutrition & Cancer: Healthy Diet

The “New American Plate”:

- American Institute for Cancer Research

Include a few meatless meals weekly.

2/3 of plate = vegetables, whole grain, beans, fruit
1/3 or less of plate = animal protein*

*Include a few meatless meals weekly.
How to Make a Plate Change

Gradually transition from the old American plate...

to a better plate...

to the New American Plate
Diet and Inflammation

• Dietary foods and its components can be pro-inflammatory, neutral, or pro-inflammatory
  • Anti-inflammatory: foods versus components
    • Foods: Fruits, Vegetables, Whole Grains, some fish
    • Components: Vitamins, Trace elements, Fiber, Phytochemicals
  • Pro-inflammatory:
    • Foods: Dairy and Meats
    • Components: Cholesterol, Saturated Fats, Animal Proteins

• Dietary Inflammatory Index – tool to evaluation whether a particular food, component and/or meal pattern is pro-inflammatory, anti-inflammatory, or neutral
  • Primarily a research tool, utilizes 45 foods/components
  • Based on evaluation of Food Frequency Questionnaire data from large cohort studies
Amino Acid Supplements to Alter Radiation Effects

• Utilize conditionally essential amino acids

• Arginine (Arg)
  • Can be both a tumor promoter and tumor suppressor
    • Why? – Multiple pathways for conversion into other metabolites
      • Nitric Oxide Synthase, Arginase
      • Altered metabolism in cancer cell

• Glutamine
  • Not the primary energy source of cells – exception: large intestine
    • Altered metabolism in cancer cell, part of proliferation cycle

• Both have been shown to decrease treatment side-effects
Amino Acids - Structure

Schematic diagrams of the 20 amino acids

(picture taken from www.chemistry.pomona.edu)

Alanine (Ala)  Arginine (Arg)  Asparagine (Asn)  Aspartic Acid (Asp)  Cysteine (Cys)

Glutamine (Gln)  Glutamic Acid (Glu)  Glycine (Gly)  Histidine (His)  Isoleucine (Ile)

Leucine (Leu)  Lysine (Lys)  Methionine (Met)  Phenylalanine (Phe)  Proline (Pro)

Serine (Ser)  Threonine (Thr)  Tryptophan (Trp)  Tyrosine (Tyr)  Valine (Val)
Glutamine Use in the Body and Cancer
Cancer pathways

But actually the big picture much more complicated, interconnected and looks more like this!!
Arginine Studies

- Preclinical
- Rat
- Human
Glutamine Studies

- Human trials
  - Gut function

- Critical Care Trials

- Mucositis – 1 Meta-analysis & 1 Systematic Review published in 2016
  - Chemotherapy
  - Radiation
  - Cancer type included
Mixed Nutrient Products

• Arginine/Glutamine/β – Hydroxy β – Methylbutyrate (Arg/Gln/HMB)
  • 2 studies, propriety blend – dosage (Juven by Abbott Nutrition)
  • Available in U.S. and internationally

• Immunonutrition Product – Arginine, Fish Oil, Nucleotides
  • Chemoradiation, 1 study to date in esophageal patients
  • Prior studies have been as oral supplement and tube feeding products
  • Product utilized in study - Impact Advanced Recovery by Nestle Health Science
Anti-oxidants

• What are anti-oxidants?
  • How body counteracts an oxidative state

• Vitamins, Trace elements, Phytochemicals
  • Vitamins: Vitamin A (retinols and carotenoids), Beta-Carotene, Vitamin C (Ascorbic Acid), Vitamin E (Tocopherols)
  • Trace Elements: Selenium
  • Phytochemicals: plant derived, thousands in foods we eat, limited data on function and optimal dosage
Anti-oxidants – Theory & Use

• Cancer treatment biology
  • Primary oncology concern: counteract effects of chemotherapy and radiation, treatment creates a pro-oxidant environment

  • 2008 – first published study showing interaction: green tea and bleomycin, green tea diminished chemotherapy effectiveness

  • Benefits: multiple studies showing decreases treatment side-effects

  • Questions: dosage, timing, oxygenation of cells
MD Anderson Radiation Dietitians
Questions ???