

Medical Nutrition Therapy

Traumatic Brain Injury can result in many physical, cognitive, and sensory issues that impede nutritional intake such as dysphasia (difficulty swallowing), problems with appetite, attention, concentration and taste. Adequate nutrition is extremely important to maintain health and promote healing, so Medical Nutrition Therapy (MNT) is often necessary.

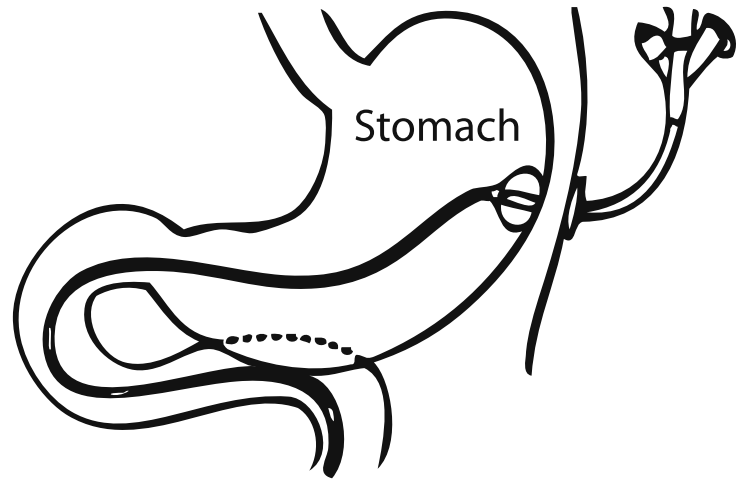
MNT is a general term for medically addressing the needs of people at nutritional risk. At risk individuals undergo screening assessments and based on the screening, a registered dietitian (RD) works with the interdisciplinary team to develop a plan of care, implement the plan and evaluate the results. One of the most important goals for Rainbow's dietitian, Catherine Hahn, is to assure that all clients are adequately nourished either by tube feeding recommendations or by counseling on daily food choices.

Nutritional Considerations

Nutritional requirements are important factors and are affected by disabilities. For example, cardiopulmonary stress may increase calorie needs, while decreasing tolerance to fluid volume. Infection or stress from surgery may increase both calorie and protein needs and certain drugs may increase the requirement for specific vitamins or minerals.

Energy or caloric needs are calculated for normal growth and development. If caloric intake is inadequate, weight and height gain will be poor. If caloric intake is excessive, weight gain will be higher than desired and Body Mass Index Ratings (BMI) will be excessive. Factors that may change caloric needs include illness or inflammation, increased seizure or physical activity, surgery, increased therapies or changes in medication. Immobility will decrease calorie needs.

Protein requirements also vary between individuals and may increase due to illness, infection, trauma, pre- and post-surgery, sepsis or major burns. Estimates of protein requirements are based on height and weight (or ideal body weight). Disease related requirements are also a considerations, such as renal or hepatic conditions. RD's use nitrogen balance to determine the amount of nitrogen (by-product of protein metabolism) required to maintain equilibrium by assessing urinary nitrogen losses. Some factors affecting nitrogen balance include the biological value of protein ingested, growth of the individual, renal function, fecal and skin losses, and anabolic/catabolic hormones.



Fluid requirements can be estimated based on weight, height, and age and depend on the following variables: Urine output, sweating, vomiting, fever, stool pattern, environment, renal disease, cardiac anomalies, tracheostomies and medications. Constant drooling may also contribute to fluid loss. Signs of dehydration include: Constipation, decreased urine output, strong smelling or dark urine, crying without tears, dry lips and skin or sunken eyes. Electrolyte imbalances must also be monitored along with fluid intake, as they may cause serious medical complications, such as hypo- and hyper-natremia (low or high sodium), hypo- and hyper-kalemia (low or high potassium) and cardiac arrhythmias.

Vitamin and mineral needs are mostly determined by Recommended Dietary Allowances (RDA) for age, unless growth is markedly delayed by illness. For a child with growth delay, the RDAs for height age can be used. Individuals with inadequate caloric intakes, decreased absorption and increased caloric needs should consider supplemental vitamins and minerals. Vitamin and mineral requirements can be altered by medications, disease, previous medical/dietary history and other factors. In general, it is a good idea for most people to take a daily multivitamin to ensure adequate nutrient intake.

Inadequate Nutrition

Under nutrition is often the result of one or more of the following:

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Decreased dietary intake, increased nutritional requirements and the impaired ability to absorb or utilize nutrients. If untreated, the effects are not limited to loss of weight, body fat and body tissue, but can have physiological and functional effects as the body attempts to adapt to nutritional deficiencies and starvation. These effects may include:

- Impaired immune function
- Delayed wound healing
- Increased risk of tissue breakdown
- Muscle wasting and weakness which may effect respiratory and cardiac function and mobility
- Altered structure of the small intestine which may result in malabsorption
- Increased risk of post-operative complications
- Apathy and depression

Individuals at high risk for inadequate nutrition may include:

- Patients unable to consume at least 75% of energy needs by mouth
- Patients with total feeding time of more than four hours per day
- Young children/infants with weight loss or no weight gain for three months or longer
- Weight for height or length less than fifth percentile for age and sex
- Triceps skin fold less than fifth percentile for age
- Severe hypoalbuminemia (low protein)

Enteral Nutrition and Tube Feeding

Many clients at Rainbow have physical and cognitive problems, making it impossible to get proper nutrition through normal eating. Enteral nutrition, or tube feeding, is a way to feed these individuals. Enteral feeding refers to the delivery of liquid feedings through a tube. It is a means of providing carbohydrates, proteins, fats, vitamins and minerals to people who are unable to eat orally. Conditions that may require enteral feeds may include:

- gastrointestinal (GI) disorders of absorption, digestion, utilization, secretion and storage of nutrients
- neuro-muscular disorders, such as muscular dystrophy, spinal cord defects and cerebral palsy or damage to the central nervous system
- Cardiopulmonary disorders and other conditions of hyper-metabolism, such as burns and some types and stages of cancer, HIV/AIDS

Fluid Needs

Fluid needs are important to consider for tube fed clients. Specific water needs for an individual can be calculated as 1 ml/kcal or 35 ml/kg usual body weight (UBW). Clients who have large water losses through perspiration or oozing wounds may require more fluid intake.

Most Enteral formulas contain 80-85% free water, and fluid needs can be met with a small amount of additional water. However, calorically dense formulas contain as little as 60% free water, so failure to supplement with water can result in dehydration. One way to assess fluid intake is to monitor urine output. Obligatory fluid output is the minimum output of urine necessary to remove waste and is estimated to be 700 ml per day or 30 ml per hour.

- Failure to thrive and/or infant prematurity

Some contra indications for enteral feeding would include:

- a malfunctioning GI tract requiring bowel rest, such as a mechanical obstruction in the intestines,
- insufficient absorptive capacity of the intestinal tract
- severe diarrhea or intractable vomiting
- GI bleeding or severe enterocolitis (intestinal infection)
- When harm may exceed the benefit of alternative feedings, such as clients with an end-stage illness, or when anticipated benefits may be uncertain or against the client's best interests with a lack of advance directives.

There are pros and cons to tube feeding. Advantages can include improved growth and nutritional status, reduced anxiety and improve quality of life, prevention or reduced risk of aspiration and improved hydration. Disadvantages can include increased risk of aspiration or vomiting with aggressive feeding, diarrhea and skin breakdown or anatomic disruption. Metabolic risks include hyperglycemia (*high blood sugar*), hyper-phosphatemia (high phosphate) and improved bowel function. Physical risks include dislodged or occluded feeding tube.

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Tube Feeding Formulas

A variety of commercial formulas are available for tube feedings and most are complete and balanced to meet nutrition requirements for specific populations. When selecting a formula, factors to consider are:

1. Protein and calorie requirements
2. Age and medical condition
3. History of food intolerance or allergy
4. Intestinal function
5. Route of delivery
6. Specific formula characteristics

Osmolality of a formula has a direct influence on the GI side effects. Osmolality refers to the concentration of osmotically active particles per liter of solution (expressed as mOsm/L) and is affected by the concentration of amino acids, carbohydrates and electrolytes in the formula. Formulas with higher osmolality produce an osmotic effect in the stomach and small intestine. The hyperosmolality draws water into the GI tract to dilute the formula concentration. The influx of water into the GI tract may cause diarrhea, nausea, cramping and distention. Isotonic formulas are designed to alleviate these problems. The osmolality of full strength isotonic formulas is similar to the osmolality of normal body fluids, approximately 300mOsm/L.

The required formula volume is determined by calculating the energy and protein needs of the client. If additional energy or calories are needed, fat and or calories can be added. Water must also be provided to meet fluid requirements to avoid dehydration. Formulas should be administered slowly at first; about 50 ml per hour, then increased by 25 ml per hour every 8-12 hours as tolerated until the required volume is met. A typical final rate is 100-125 ml /hr.

Administration of Tube Feeding

Tube feeding may be administered by bolus feedings, continuous drip feedings or a combination of the two. Bolus feedings are delivered four to eight times per day, each lasting about 15-30 minutes and are similar to normal feeding patterns provided at mealtimes. They are convenient, less expensive (if a pump is not required), and allow freedom of movement because the patient is not attached to a feeding bag. Some disadvantages include easier aspiration compared to continuous drip feedings, bloating, cramping, nausea and diarrhea. This method may not be practical for individuals requiring large volumes or frequent

administration of formula.

Continuous drip feeds infuse formula without interruption. They are more expensive because they use a pump and additional feeding supplies, and limit mobility because the patient is attached to the equipment. A continuous feed may elevate insulin levels contributing to hypo- and hyperglycemia. Continuous drip feeds are typically used for 8 to 10 hours during the night for volume sensitive individuals and smaller bolus feeds can be used during the day. Continuous drip feeds are delivered by a gravity drip or an infusion pump, which is a better method because gravity drips can be inconsistent and need frequent checks.

Medication Administration

Medications may be administered when using the bolus feeding method, but a physician or pharmacist should be consulted. Liquid medication should be used over pills or capsules, but if not available, some tablets/pills can be crushed and dissolved in 30-50cc's of water. Formula, juice or milk may be used if the medication does not dissolve. Gel caps can be cut open and the contents squeezed out and most can be dissolved in very hot water, then cooled with ice cubes. Highly viscous liquids (sticky, gummy, gelatinous liquid) should be diluted with water prior to administration. *NOTE: Certain medications should NOT be crushed or dissolved and certain medications should not be mixed. Some medications can be added to the tube fed formula, but drug-nutrient interactions may occur. Some drugs can cause the formula to clump and clog the feeding tube. Also, placement of the feeding tube can affect drug action. Some drugs require the acidic environment of the stomach to be dissolved, and therefore may not be well absorbed if the feeding tube is placed in the intestine.*

Monitoring for Tolerance

Patients must be carefully monitored for tolerance of formula, hydration status and adequacy of nutritional support. Always look for symptoms including diarrhea, nausea, cramping, constipation and aspiration. Hydration status can be monitored via daily weights, hematocrit, blood urea nitrogen (BUN) and electrolytes. High values for the above parameters indicate dehydration. Nutritional assessment indicators of protein status can be used to determine adequacy of protein intake and weight can be used to determine adequacy of calories, unless the individual is retaining fluid.

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Tube Feeding Formulas

Many companies produce nutritionally complete standard formulas made of complex proteins, fats, carbohydrates, vitamins and minerals. These formulas are designed for patients who have normal digestion but cannot orally consume adequate calories and nutrients. They generally have low osmolality and are usually lactose-free, palatable, sterile and easy to use. Some formulas have added fiber to promote regular bowel movements.

Elemental formulas are made from predigested nutrients including amino acids or hydrolyzed protein, carbohydrate and fat in the form of medium-chain triglycerides or essential fatty acids. They contain all essential vitamins and minerals. The major advantage of elemental formulas is that little or no digestion is required, so stool volume is low and bile/pancreatic secretions are minimal. The disadvantage is that they are hyperosmolar and may cause cramping and osmotic diarrhea. Elemental formulas should be used for individuals with short gut syndrome, malabsorption syndromes, inflammatory bowel disease, gastrointestinal fistulas, nonspecific maldigestive and malabsorptive states. They are not appropriate for people with functioning gastrointestinal (GI) tracts.

Blenderized home-prepared formulas are time consuming, but less expensive than commercial formulas. When preparing a homemade formula, sanitary precautions are necessary to prevent contamination and supplements may be needed to meet nutrient requirements. In addition, home blended formulas tend to be more viscous and may clog narrow feeding tubes. Milk or infant formulas can serve as a base for the blenderized diet, but a dietitian should carefully monitor these formulas.

Modular formulas are not complete formulas. They contain only specific nutrients and can be added to commercial or home-prepared formulas. Examples include medium chain triglycerides (MCT oils), which are easily digested additional calories and protein and specific amino acid preparations (Casec or Promod) used for additional protein.

Specialized formulas are available for special needs such as diabetes, renal or hepatic disease. Other conditions may include trauma or severe stress states, or respiratory conditions. A physician or a dietitian who is familiar with products should select these formulas and their particular uses. Summary

A multidisciplinary treatment team approach is essential for the effective planning, administration and monitoring of a client's nutritional status. Tube feeding is one very safe and effective treatment option for those clients' who are otherwise unable to meet their nutrition needs. ❖

Written by Catherine Hahn, MS RD, Dietitian & Vicky Scott, RNC, NP, Nurse Practitioner

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