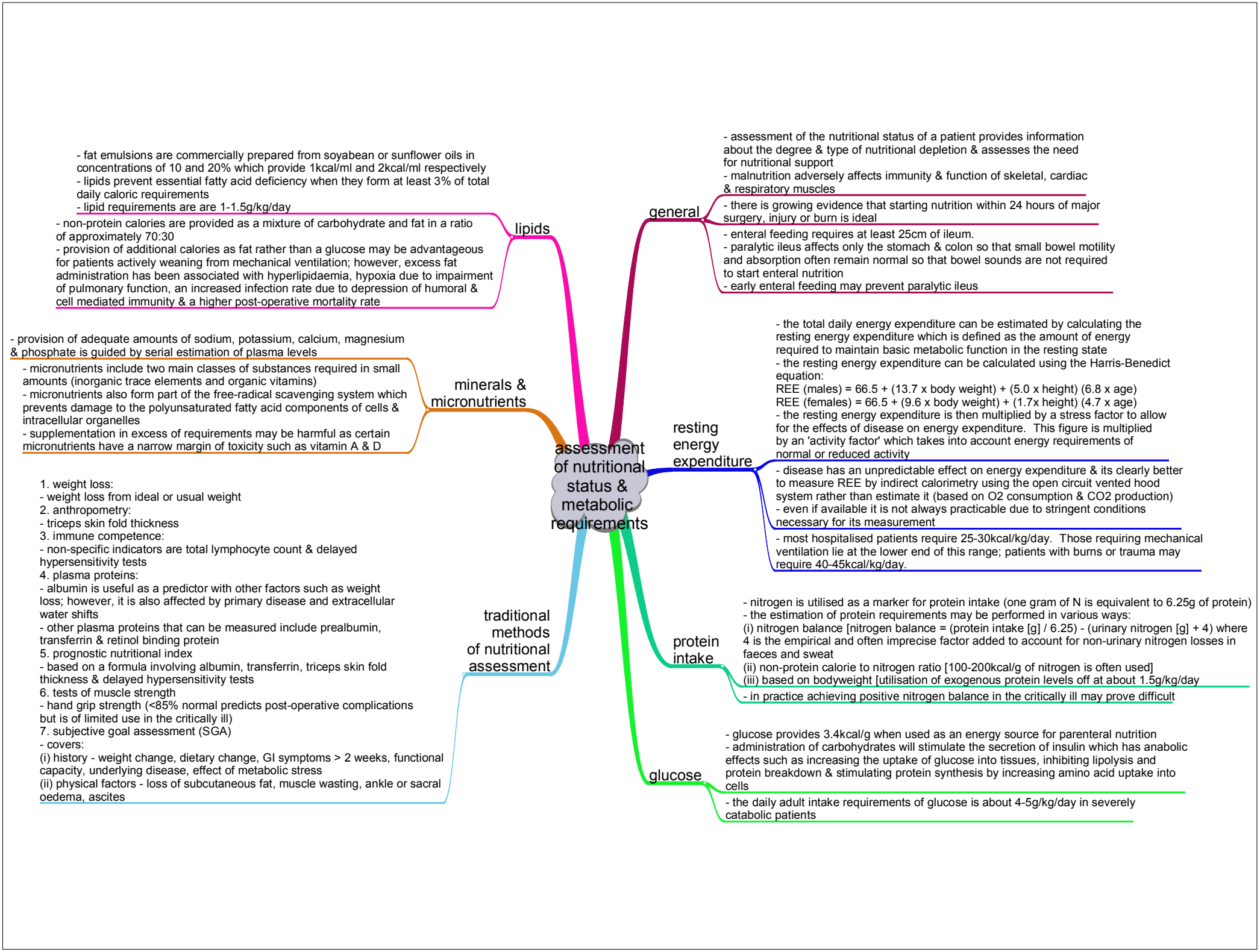
assessment of nutritional status & metabolic requirements
general
- assessment of the nutritional status of a patient provides information about the degree & type of nutritional depletion & assesses the need for nutritional support
- malnutrition adversely affects immunity & function of skeletal, cardiac & respiratory muscles
- there is growing evidence that starting nutrition within 24 hours of major surgery, injury or burn is ideal
- enteral feeding requires at least 25cm of ileum.
- paralytic ileus affects only the stomach & colon so that small bowel motility and absorption often remain normal so that bowel sounds are not required to start enteral nutrition
- early enteral feeding may prevent paralytic ileus
resting energy expenditure
- the total daily energy expenditure can be estimated by calculating the resting energy expenditure which is defined as the amount of energy required to maintain basic metabolic function in the resting state
- the resting energy expenditure can be calculated using the Harris-Benedict equation:
REE (males) = 66.5 + (13.7 x body weight) + (5.0 x height) (6.8 x age)
REE (females) = 66.5 + (9.6 x body weight) + (1.7x height) (4.7 x age)
- the resting energy expenditure is then multiplied by a stress factor to allow for the effects of disease on energy expenditure. This figure is multiplied by an 'activity factor' which takes into account energy requirements of normal or reduced activity
- disease has an unpredictable effect on energy expenditure & its clearly better to measure REE by indirect calorimetry using the open circuit vented hood system rather than estimate it (based on O2 consumption & CO2 production)
- even if available it is not always practicable due to stringent conditions necessary for its measurement
- most hospitalised patients require 25-30kcal/kg/day. Those requiring mechanical ventilation lie at the lower end of this range; patients with burns or trauma may require 40-45kcal/kg/day.
protein intake
- nitrogen is utilised as a marker for protein intake (one gram of N is equivalent to 6.25g of protein)
- the estimation of protein requirements may be performed in various ways:
(i) nitrogen balance [nitrogen balance = (protein intake [g] / 6.25) - (urinary nitrogen [g] + 4) where 4 is the empirical and often imprecise factor added to account for non-urinary nitrogen losses in faeces and sweat
(ii) non-protein calorie to nitrogen ratio [100-200kcal/g of nitrogen is often used]
(iii) based on bodyweight [utilisation of exogenous protein levels off at about 1.5g/kg/day
- in practice achieving positive nitrogen balance in the critically ill may prove difficult
glucose
- glucose provides 3.4kcal/g when used as an energy source for parenteral nutrition
- administration of carbohydrates will stimulate the secretion of insulin which has anabolic effects such as increasing the uptake of glucose into tissues, inhibiting lipolysis and protein breakdown & stimulating protein synthesis by increasing amino acid uptake into cells
- the daily adult intake requirements of glucose is about 4-5g/kg/day in severely catabolic patients
traditional methods of nutritional assessment
1. weight loss:
- weight loss from ideal or usual weight
2. anthropometry:
- triceps skin fold thickness
3. immune competence:
- non-specific indicators are total lymphocyte count & delayed hypersensitivity tests
4. plasma proteins:
- albumin is useful as a predictor with other factors such as weight loss; however, it is also affected by primary disease and extracellular water shifts
- other plasma proteins that can be measured include prealbumin, transferrin & retinol binding protein
5. prognostic nutritional index
- based on a formula involving albumin, transferrin, triceps skin fold thickness & delayed hypersensitivity tests
6. tests of muscle strength
- hand grip strength (<85% normal predicts post-operative complications but is of limited use in the critically ill)
7. subjective goal assessment (SGA)
- covers:
(i) history - weight change, dietary change, GI symptoms > 2 weeks, functional capacity, underlying disease, effect of metabolic stress
(ii) physical factors - loss of subcutaneous fat, muscle wasting, ankle or sacral oedema, ascites
minerals & micronutrients
- provision of adequate amounts of sodium, potassium, calcium, magnesium & phosphate is guided by serial estimation of plasma levels
- micronutrients include two main classes of substances required in small amounts (inorganic trace elements and organic vitamins)
- micronutrients also form part of the free-radical scavenging system which prevents damage to the polyunsaturated fatty acid components of cells & intracellular organelles
- supplementation in excess of requirements may be harmful as certain micronutrients have a narrow margin of toxicity such as vitamin A & D
lipids
- fat emulsions are commercially prepared from soyabean or sunflower oils in concentrations of 10 and 20% which provide 1kcal/ml and 2kcal/ml respectively
- lipids prevent essential fatty acid deficiency when they form at least 3% of total daily caloric requirements
- lipid requirements are are 1-1.5g/kg/day
- non-protein calories are provided as a mixture of carbohydrate and fat in a ratio of approximately 70:30
- provision of additional calories as fat rather than a glucose may be advantageous for patients actively weaning from mechanical ventilation; however, excess fat administration has been associated with hyperlipidaemia, hypoxia due to impairment of pulmonary function, an increased infection rate due to depression of humoral & cell mediated immunity & a higher post-operative mortality rate