nutrition [created by Paul Young 20/12/07]

enteral vs parenteral nutrition

general
- In the past 15 years there has been a move away from providing nutrition support intravenously (parenteral nutrition, PN) to providing it nasogastrically or jejunally (enteral nutrition, EN).
- The underlying basis in favour of EN is that a failure to maintain normal oral nutrition is associated with immunological changes and impairment of the gut associated lymphatic system (GALT) that leads to the intestine, through lymphatic drainage, becoming the source of activated cells and proinflammatory stimulants during gut starvation.
- Other secondary abnormalities such as permeability changes and occasionally even bacterial translocations increase the immune challenge to the GALT but their contribution is secondary.

trial data
- One of the largest meta-analysis of 27 studies in 1828 surgical patients confirms that enteral feeding does carry a lower infective risk than PN RR 0.66 (95% CI 0.56 to 0.79), but with overall no advantageous effect on mortality risk RR 0.96 (95% CI 0.55 to 1.65).
- short term standard intravenous fluids regimen used in the normally nourished surgical patient has a lower risk of infection RR 0.77 (95% CI 0.65 to 0.91) than the inappropriate early use of PN in these patients. In contrast in the malnourished patient unable to tolerate enteral feeding not giving parenteral feed significantly increases the mortality risk threefold, RR 3.0 (95% CI 1.09 to 8.56).
- A 14 hospital cluster study from Canada, the ACCEPT study, showed that survival from intensive care was improved when an evidence based guideline for nutrition was followed and more nutrition was delivered more consistently. This was achieved by earlier introduction and more complete EN delivery without any decline in the use of PN alone or in supplementation.
- In a well designed randomised, controlled study in a French mixed general ICU population (n=120) it was shown that achieving a higher nutrition intake with parenteral supplements led to a faster recovery of plasma protein markers, their primary end point. They also showed a reduction in length of hospital stay of 2.5 days but it is doubtful if the power of the study was sufficient to convincingly prove this.

advantages of enteral vs parenteral nutrition:
(i) enteral feeding is cheaper
(ii) there is more efficient utilisation of nutrients
(iii) stimulates intestinal blood flow
(iv) maintains GI mucosal barrier, preventing bacterial translocation & portal endotoxaemia
(v) disuse atrophy of the GI tract occurs rapidly without enteral feeding
(vi) post-operative enteral feeding reduces septic complications compared with parenteral
(vii) avoids complications of central venous cannulation
(viii) avoids TPN induced immunosuppression

aspiration risk

general
- aspiration can occur during many nursing procedures and turning but it is unclear how much the complication of pneumonia is related to direct feed aspiration (incidence 22% range 0%-94%) rather than changed pharyngeal colonisation secondary to feed regurgitation (incidence 31% range 0%-94%).

trials:
- A recent study in France of 153 nasogastrically fed patients showed that upper digestive intolerance is a frequent event in the critically ill and associated with pneumonia (43% v 24% p=0.01), longer ICU stay (23 v 15 days p=0.007), and increased mortality (41% v 25% p=0.03).30 Even corrected for illness severity the risk of death was significantly increased RR 1.48 (95% CI 1.04 to 2.10).
- This increased risk for intolerance is correlated with sedation use (RR 1.78 95% CI 1.17 to 2.71) and catecholamine use (RR 1.81, 95% CI 1.21 to 2.70) both features of genuine intensive care patients, particularly those with sepsis and shock.
- The evidence that using motility agents or nasojejunal (NJ) feeding rather than nasogastric (NG) feeding significantly changes these risks is lacking.

NJ feeding:
- A multicentre study from Spain confirms that NJ feeding does not reduce the incidence of pneumonia. In 101 randomised ICU patients there was no difference in feeding duration, length of stay, or mortality (NG 43% v NJ 38%). Although the NJ group had lower gastrointenstinal complications there was a similar incidence of nosocomial pneumonia (NG 40% v NJ 32%).
- While a study from Melbourne suggested improved tolerance with NJ feeding and a low requirement for PN another study in USA medical patients showed that NG fed patients reached their target goal earlier.
- A rare but often fatal complication of non-occlusive bowel necrosis has been reported in critically ill trauma patients fed into the small bowel. As this serious complication cannot be detected early there is no overwhelming risk free evidence supporting NJ feeding in preference to NG feeding for the reduction in infective risk.

summary

- Feed the malnourished and plan for those soon to be
- Start some enteral feeding if safe and as soon as practical.
- Use simple standard complete regimens, decisions over volumes of fluid dominate.
- Modest targets based on patient size bands are easier to achieve (25 kcal/kg/day with 1.5 g protein/kg/day).
- Use protocols, monitor delivery, note deficits, and act to meet targets.
- Use parenteral to complement or replace if delivery fails.
- Give sufficient insulin for glycaemic control using established protocols.
- Do not exacerbate glutamine deficiency, include in all PN preparations.
- Don't miss feeding because it is harder to catch up.

recognition of prior nutritional status

- Many patients admitted in emergency may have been suffering an illness and have had poor nutrition before admission to intensive care. The best assessment of prior nutritional state is a detailed history of prior illness and nutritional intake combined with clinical examination of fat and muscle distribution.
- Body mass index (BMI = weight in kg/height in m2) is useful but weight can be difficult to obtain accurately and may be distorted by resuscitative fluid administration.
- We know that ICU patients suffering from under-nutrition with a limited nutrition reserve have a poorer outcome and that having a low BMI has been shown to be an independent predictor of excess mortality in multiple organ failure.

indirect calorimetry

- indirect calorimetry results are derived from measurements of oxygen consumption and CO2 production in ventilated patients
- an RQ <0.85 may indicate underfeeding while and RQ>1 may indicate overfeeding although these findings are neither sensitive nor specific
- the RQ for fat is 0.7, for protein is 0.8 and for carbohydrate is 1.0
- patients failing to wean from ventilation who have high RQs and are receiving feeds high in carbohydrate may theoretically benefit from feeds with a lower RQ such as those with a higher ratio of fat to carbohydrate

- potential errors from indirect calorimetry include:
(i) measurements are not taken when patients are in a steady state
(ii) presence of air leaks (eg circuit, endotracheal tube cuff, pneumothorax with ICC)
(iii) high FiO2
(iv) high respiratory rate
(v) water is in the circuit

metabolic changes in critical illness

- The enormous endocrine and cytokine flux of systemic inflammatory response common to sepsis or major trauma will increase basal metabolic rate usually proportional to the degree of insult and this is compounded by the effects of treatments such as adrenergic inotropes.
- The loss of lean body mass (whole body water and protein) that ranges from 0.5% to 1.0% loss per day is far greater than that attributable to bed rest alone.
- The rapidity and extent of the catabolic muscle wasting in the critically ill is a reduction in muscle fibre cross sectional area of 3%-4% per day.
- In the first couple of weeks despite a 35%-50% decline in respiratory and skeletal muscle function there is no loss of cardiac mass or function in critically ill patients however wasting does occur with protracted illness.
- Muscle wasting is ultimately a balance between protein synthesis and degradation.
- After modest surgery there is a decrease in whole body protein synthesis rather than breakdown.
- Short term starvation decreases skeletal muscle protein synthesis.
- With trauma and major surgery both synthesis and degradation increase, the latter being more enhanced.
- in multiple organ failure increased whole body protein breakdown predominates over increased protein synthesis. To meet this metabolic demand for substrates involved in protein synthesis increased proteolysis occurs, particularly in skeletal muscle.
- The provision of high quality (essential and conditionally essential) amino acids along with insulin is central to good nutritional provision in the critically ill. As amino acids are not stored but used in synthesis or metabolised the provision needs to meet on going protein synthetic demand.

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nutritional targets

- Currently recommendations suggest that 25 kcal/kg/day (105 kJ/kg/day) is a reasonable target intake for ICU patients initially for the first week however if too rigorously adhered to especially in some sepsis and trauma patients may be inadequate in the long run and a target of 30 or 35 kcal/kg/day may be more appropriate in subsequent weeks.
- Several surveys have shown that the real practice in intensive care is to deliver considerably less than that prescribed ranging between 50% and 60% of target.
- What is "sufficient" is open to debate and there are some advocates of deliberate underfeeding. However, underfeeding is a concern as it has been suggested that medical ICU patients who received less than 25% of target feed have a higher risk of nosocomial blood stream infections.
- Currently the best evidence in ICU based upon whole body measurements suggests at least 1.2-1.5 g/kg/day of protein are needed.

glutamine

- The first double blind randomised outcome study comparing a standard PN with a glutamine enhanced PN within intensive care patients with gut failure as part of multi-organ failure showed a significantly improved six month survival (24 of 42 compared with 14 of 42, p=0.049).
- Subsequent data showed that glutamine recipients have a significantly lower incidence of catheter related infections (p=0.026), but overall only a non-significant and modest reduction in early acquired infections as the opportunity for new infections is so high in these patients.