

Nutrition in Critical Care

Paradigm Shift

- Enteral nutrition in the past
 - Once considered supportive therapy
 - Protected endogenous stores
 - Preserve lean mass
 - Protect against protein catabolism
- Present
 - Primary therapeutic tool
 - Affects outcomes

Gut Use

- Enteral feeds promote gut health
 - Maintains mucosal mass
 - Stim. cell proliferation/brush border enzymes
 - Maintains villus height
- Provide colonization resistance
 - sIgA/bile salts coat bacteria
 - Enteral nutrients maintain tight junctions
 - Help prevent pathogenic bacterial overgrowth

Gut Disuse

- Impairs function and integrity
 - Mucosal mass and villus height decreased
 - Increases permeability of gut
 - Correlates inversely with % of goal calories provided enterally
 - Starvation alone not enough, but occurs if followed by injury
- Leads to bacterial overgrowth
 - Reduced peristalsis
 - Decreased sIgA/bile salts
- Can occur with as little as 5 days

Immune Function

- Dendritic macrophages present antigen to naïve T cells (Th0)
- IL-12 secretion stim Th1 response
 - Th1 response inflammatory
 - TNF- α , IL-2, gamma interferon secretion
- IL-4 secretion stim Th2 response
 - Th2 response anti-inflammatory
 - More IL-4, IL-6, and IL-10
- Balance determines whether response appropriate, causes self injury, or immunosuppression

Enteral Feeds and Immune Response

- Normal enteral feeds promote Th2 cells
 - Releases pro IgA cytokines (IL-4, IL-10, etc.)
 - Counter balanced by normal level of Th1 activity
- Gut disuse (with or without PN)
 - Reduces IL-4/IL-10 secretion, inhibiting Th2 activity
 - Does not affect Th1 activity
 - Unbalances Th1/Th2 ratio

Gut Disease and Adhesion Molecules

- Decreased MADCAM-1 expression
 - 60% reduction within 4 days in animal models
 - MADCAM-1 primary ligand for B cell homing
 - Absence means lower numbers of B cells in Peyer's patches
- Increased ICAM-1 and E-selectin on pulmonary endothelium
 - E-selectin promotes sequestration of PMNs
 - Causes PMNs to accumulate in lung/worsens organ injury

Impact on Outcomes

- EN vs. PN
 - Gramlich and Heyland 2004 (Analysis of 13 RCT studies)
 - No statistical difference in mortality
 - Decreased infection rate
- Early vs. delayed EN (8 RCTs)
 - Benefits approach sig (infection/mortality)
 - Nutritional endpoints showed benefit of early EN

Delivery Method & Outcome

- Feedings distal to pylorus (Heyland et al 2002)
 - Decreased VAP
 - Shorter time to target calories
- Semi-recumbent position (Drakulovic et al 1999)
 - Decreased GERD
 - Decreased VAP
- Proton Pump Inhibitors (Booth et al 2002)
 - Conflicting data
 - Erythromycin helpful with tube placement in 2 studies
 - Metoclopramide probably not helpful with placement
 - Proton pump inhibitors help with tolerance in most studies

Assessment

- Identify high risk patients
 - Recent weight loss/underweight at baseline
 - NPO for extended period of time
- Evaluate GI status
 - Hemodynamic stability
 - Gastric emptying
 - Intestinal motility

Importance of Enteral Feeds

- Greater importance in sicker patients
 - Trauma patients (Kudsk et al 1992)
 - Acute pancreatitis (Windsor et al 1998)
- Are “trophic” feeds enough?
- 50-65% of goal may be necessary (Peng et al 2001)
- Some patients may require oligopeptide formulas (McClave, 1995)

Parenteral Nutrition

- EN first-line therapy
- Second-line therapy depends upon patient
 - In most patients, standard therapy (IVFs with dextrose)
 - Sig reduction in infections and length of stay
 - Trend toward reduced overall complications
 - PCM patients however, benefit from TPN
 - Sig reduction in complications with TPN
 - Trend toward increased infections w/IVFs alone

Lipids

- Controversial
 - Bastistella et al 1997 (trauma pts w/lipids)
 - More pneumonia
 - Higher catheter sepsis rate
 - Longer ICU & hospital stay
 - McCowen et al 2000 (hypocaloric regimen w/o lipids)
 - Trend towards reduced infection
- Should lipid-free PN be provided to short-term PN pts?

Hyperglycemia

- Hyperglycemia is not good!
 - Impaired neutrophil & antibody function
 - Poor wound healing
 - Exacerbates inflammation
- PN often leads to hyperglycemia
 - More carbs
 - More calories
 - More stress

Hyperglycemia and Infection

- Moore et al 1992 (PN vs EN in trauma pts)
 - EN had lower glucose (132 mg/dL)
 - PN had higher (200mg/dL)
 - PN had 44% infection, EN 17%
- Kudsk et al 2001 (PN vs EN in trauma pts)
 - **>220mg/dL = 53% infection**
 - <220mg/dL = 23% infection
- Hyperglycemia leads to higher infection rates

Intensive Insulin Therapy

- Van den Berghe et al 2001 – RCT in surgical pts on mech ventilation (n=1548)
 - Intensive insulin therapy (80-110mg/dL)
 - Standard therapy (insulin only if >215mg/dL)
- Results
 - Decreased sepsis
 - Decreased ICU stay
 - Decreased mortality (by 34%)