

NUTRITIONAL MANAGEMENT OF IMMUNODEFICIENT CHILDREN

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CAUSES OF IMMUNODEFICIENCY

- PRIMARY

Results from innate defects of the immune system

- SECONDARY

Pathological processes affecting the immune system eg malignancy, drugs, steroids, infections (TB, HIV)

RESULTS OF IMMUNODEFICIENCY

- Recurrent or persistent infections
- Organisms with low virulence/opportunistic agents
- Abnormal host response to infectious & non-infectious stimuli
- Immunodeficiency does not affect nutrition but the secondary effects compromise nutritional status

FOOD-BORNE INFECTION & IMMUNODEFICIENCY

- Reduced immunocompetence increases susceptibility to food-borne infection
- All children who are immunocompromised should follow at least a precautionary diet
- Immunosuppressed children particularly those undergoing bone marrow transplantation may benefit from extra precautions

LOW MICROBIAL DIETS IN BONE MARROW TRANSPLANTS

- Hypothesis – low microbial diets should reduce risk of food-borne infection
- Recommendations based on theoretical concepts rather than clinical trials
- Great variety in protocols amongs different centres

HIGH RISK FOODS

- Milk and yoghurt – unpasteurised
- Cheese – soft & blue veined varieties
- Cold meats
- Shellfish
- Eggs – raw or soft cooked
- Fruit & vegetables – raw & unpeeled, fresh juice
- Honey
- Fast or take-away foods
- Foods from street vendors

MEDIUM RISK FOODS

- Ice cream, fresh cream
- Meats & fish purchased unpackaged
- Pizza –purchased cooked
- Processed meats – sausages, kebabs
- Dried fruits – eg raisins
- Nuts
- Mineral water
- Restaurant foods
- Boiled rice (unless bought pack & eaten immed)
- Unpackaged cereal foods (eg bread)

LOW RISK FOODS

- Milk & yoghurt –UHT or pasteurised
- Cheese (hard), butter
- Eggs – hard cooked
- Meats & fish – purchased packaged & chilled /frozen or canned
- Fruits & Vegetables – peeled, canned, cooked
- Soft drinks – individual bottle/can/carton
- Packaged confectionary
- Crisps & packaged savoury snacks

PRECAUTIONARY DIET

- Food hygiene recommendations
- Use low & medium risk foods
- Avoid high-risk foods and eating out
- Infants – breast feeding helps
- Particular care with preparation of infant formulae and weaning foods

CLEAN DIET

- Use only low-risk foods
- Use individual packets of foods if possible
- Use boiled or sterile water
- Purchasing, preparation & general hygiene
- Sometimes prepared in separate kitchen

TIMING OF LOW MICROBIAL DIET

- Initiation - On admission for transplant
 - On entry to isolation room
 - When Neutrophils < 500 units/ml
- Stopping criteria - Neutrophils > 1000 units/ml

EFFECTS ON UPPER GI TRACT

- Gastro-oesophageal reflux
(20% of children with SCIDS), worsens damage to oesophagus & lungs
- Sore mouth
Candidial oesophagitis, gastritis (common in leucocyte adhesion deficiency) causes loss of appetite and failure to thrive

SMALL & LARGE BOWEL EFFECTS

- Small bowel enteropathy

Chronic granulomatous disease – protein losing enteropathy, small bowel obstruction, motility disorders, lactose intolerance

- Colitis

(many primary & secondary disorders) –often mimics Crohns disease, refractory diarrhoea, loss of fluid & salts, milk protein intolerance, gluten intolerance

CAUSES OF GASTROINTESTINAL PATHOLOGY

- Infection
 - may be specific organism, typical of disease
 - alters gut permeability, loss of digestive enzymes
 - decreases appetite

- Drug therapy
 - may change gut epithelium
 - causes anorexia, nausea, vomiting

VICIOUS CYCLE

- Immune enteropathy --- poor appetite and nutrient losses --- Poor nutrition --- Immunodeficiency --- Immune enteropathy

MANAGEMENT OF GI SYMPTOMS

- Treat symptomatically
 - Gastro-oesophageal reflux
 - Sore mouth & gastritis
- Nutritional support: routine enteral tube for chemotherapy, immunodeficiency, BMT
- Manage allergies & intolerances
 - Lactose, milk protein, gluten/wheat, egg, soya

MANAGEMENT OF MALABSORPTION (1)

- Keep hydrated
 - Consider enteral infusion
 - May require oral rehydration solution
- Parenteral nutrition
 - maintain min enteral intake, particularly for infants
 - Very slow progression into enteral feeds

MANAGEMENT OF MALABSORPTION (2)

- Nutritional support (PN + enteral) should cover at least EAR and RNI for protein and vits/mins
- Breast milk, protein hydrolysates (Pepdite, peptijunior) or aminoacid formulae (Neocate) can be used when not tolerated. Increase feed conc slowly to avoid osmotic diarrhoea.
- Diet empirically free of milk, wheat, egg, soya
- Modular feeds (eg comminuted chicken meat)

MANAGEMENT OF MALABSORPTION (3)

Infants: Slow introduction of foods (Cant & Bailes, 1984)

- Milk-free baby rice
- Pureed root vegetables (potatoes, carrots, parsnip, swede, turnip)
- Pureed fruit (apple, pear, banana, no citrus until 8 mo)
- Pulses (lentils, beans, peas)
- Cereals (no wheat until 8 mo)
- Lamb, turkey and other meats
- Fish, eggs, cows milk not before 1 year

MANAGEMENT OF MALABSORPTION (4)

Older child:

- ‘Few foods diet’: Start with one food unlikely to cause problem (eg rice, chicken) and introduce one additional food at a time
- Diet free of milk, wheat, egg, soya may be sufficient in some cases

HIV

- Malabsorption with/without diarrhoea common, higher nutritional requirements, poor appetite, failure to thrive
- Highly active antiretroviral treatment improved prognosis
- Side effects: lipodystrophy, obesity
- Breast feeding: Developing countries

HIV: NUTRITIONAL MANAGEMENT (1)

- Patients not on HAART or failing HAART:
 - Regular growth monitoring (1 mo)
 - Aim for EAR and 1.5 times RNI for protein and RNI for Vitamins/minerals, depending on growth
 - Concentrate infant formula, may need to add CHO, lipid supplements to tolerance
 - Enteral feeding: Gastrostomy
 - Protein hydrolysate, aminoacid formulae

HIV: NUTRITIONAL MANAGEMENT (2)

- Asymptomatic patients on HAART (normal lymphocyte counts, low viral load)
 - Monitor growth
 - Monitor blood lipids, cholesterol
 - Anthropometric measurements: waist/hip ratio, atrophy of legs, fat disposition at the back of neck, face

NUTRITION & IMMUNOCOMPETENCE (1)

- Vitamin A deficiency
 - causes secondary immunodeficiency
 - affects epithelial integrity

- Iron
 - excess iron depresses immune function
 - Deficiency decreases lymphocytes

NUTRITION & IMMUNOCOMPETENCE (2)

- Vitamin D: some immunomodulatory effects
- Fe & Vit D deficiency often co-exist
- Zn deficiency: lymphoid atrophy, phagocyte dysfunction

TYPES OF DIET & IMMUNOCOMPETENCE

- Parenteral nutrition shown to depress immune function
- High linoleic acid content of diet particularly combined with riboflavin deficiency inhibits lymphocyte efficiency
- Intravenous lipid may decrease host defence but no clear evidence. New lipid products may overcome problems

IMMUNE-ENHANCING NUTRIENTS & FOODS

- High (not excessive) intake of Fe, Zn, vitA, vitE, Se
- Use paediatric micronutrient supplement if child is eating normal foods
- Optimum balance of $\omega 6$: $\omega 3$ fatty acids, probably 1:0.2. Supplement with $\omega 6$ if necessary

IMMUNE-ENHANCING NUTRIENTS & FOODS

- Oral supplement of essential fatty acids (walnut oil) if no lipid in parenteral nutrition
- Usefulness of specific nutrients (glutamine, arginine) and probiotics (live or heat-treated) not fully evaluated in paediatrics

SUMMARY

- Children who are immunocompromised should be protected from food-borne infection
- GI symptoms are common and should be treated symptomatically
- Ensure high (not excessive) nutrient intake using appropriate nutrition support; EAR, RNI