Prolonged No Enteral Nutrition In NICU

(Pathophysiology and Recent Management)

Essay

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ABSTRACT

Critically ill neonates hospitalized in ICU, especially those undergoing surgery and very low birth weight (VLBW) preterms, are often kept on parenteral nutrition for a long period of time. While the prevailing thought is this practice minimizes the risk of gastrointestinal tract (GIT) complications during acute phase of illness such as necrotizing enterocolitis (NEC), on the other hand, NPO predisposes the neonatal gut to consequences of gut atrophy and luminal starvation, depending on the fact that the gut is an experienced organ which is physiologically active and primed for the activities of food assimilation. This is because the fetus swallows amniotic fluid, which contains a variety of substances and growth factors that stimulate GIT development. Making the newborn withholding feeding creates an abnormal physiological situation and predisposes the infant to the negative consequences of no enteral feeding, as: gut atrophy and luminal starvation, which will lead to bacterial translocation and impaired immune function that will lead to more dangerous complications. These negative consequences can be reversed or prevented by early introduction of enteral nutrients including gut priming **[Strodtbeck, 2003].**

In severe surgical conditions and VLBW preterms in which there is no way except NPO, total parenteral nutrition (TPN) has made great revolution, however it is not a benign technology with many complications as; sepsis, cholestasis, hemorrhage, metabolic derangements, osteopenia, catheter complications in addition to gut atrophy **[Hack and Fanaroff, 1999; Thureen et al, 2003].**

It was found that addition of glutamine to TPN is beneficial, despite the fact that it is a nonessential amino acid; it is the preferred fuel for enterocytes. It has been shown that it reverses gut atrophy, decreases intestinal permeability and bacterial translocation; in addition it improves immune activities of the gut **[Shiphley, 1996; Reeds and Burrin, 2001].**

Despite all these parenteral interventions still it can be said that with minimal enteral feeding increased gradually whenever we can start with neonates especially preterms is much better with shortening period of hospitalization. Enteral feeding is the best for the gut processes as physical, mechanical, physiological and immunological barrier. In VLBW and ELBW with underdeveloped GIT, there are new directions towards the usage of what is called artificial amniotic fluid due to its

importance in gut development, and therefore early administration of enteral feeding with improving of the general condition and shortening of hospitalization which is very important from the financial point of view especially in developing countries **[Ross, 2003].**

Key Words

NPO- Enteral nutrition- Parenteral nutrition- Gut immunological function- Necrotizinig enterocolitis- TPN- Glutamine- Artificial amniotic fluid- Probiotics- Preterm nutrition in NICU.

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List of Abbreviations

APC…… ……..Antigen presenting cells
ARA……. …….Arachdonic acid
DCs…… .Dendritic cells
DHA……...Docosohexanoic acid
EGF……...Epidermal growth factor
ELBW……... Extremely loe birth weight
ENT……Enteral nutrition
FAE……...Follicle associated epithelium
GALT……..Gut associated lymphoid tissue
GGT……Gamma glutamyl transpeptidase
GIT……..Gastrointestinal tract
GR……Gastric residue
IGF……...Insulin like growth factor
IL……Interlukins
LF……Lactoferrin
L/R ratio……...Lactose/ Rhaminose ratio
MALT……..Mucosa associated lymphoid tissue
M-cells……Membrane cells
MODS……..Multiple organ dysfunction syndrome
NALT……..Nasal associated lymphoid tissue
NEC…. ……Necrotizing enterocolitis
NG…….Nasogastric
NICHD…….National institute of child health and human development
NICU……..Neonatal intensive care
NPO…….Nothing per orum
PCVCs……...Percutaneous central venous catheter
PICCs……...Peripherally inserted central catheters
PTE……..Pediatric trace element
PUFA……Poly unsaturated fatty acid
rh- LF…….recombinant human lactoferrin
S IgA…….secretory immunoglobulin A
S IgM……..secretory immunoglobuline M
TG……..Triglycerides
TGF-B…….Transforming growth factor B
TNF…….Tumor necrosis factor
TPN…….Total parenteral nutrition
VLBW……..Very low birth weight
UAC……Umbilical catheter

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INTRODUCTION AND AIM OF WORK

Introduction

The traditional view of the intestine has focused on its function as an organ of digestion, nutrient absorption and fermentation. However, it has become very clear that the intestine is a complex, multicellular organ that performs a number of critical physiologic functions that are separate from its role in nutrient assimilation. The intestinal mucosa contains secretory, immune and neuroendocrine cells in addition to the absorptive enterocytes. Thus, the intestinal tissues are involved in immune surveillance and in generating endocrine responses to the luminal environment **[Burrin et al, 2000].**

These regulatory roles are supported by an intrinsic intestinal neural system that is separate from, but functionally related to the central neural pathways **[Kudsk, 2000].** Thus, the intestine is one partner in a central-peripheral system that senses both the antigenic and the nutritional environment and thereby modifies the host response. The host pays a metabolic price for these critical intestinal functions. The portal drained viscera (stomach, intestine, pancreas, and spleen) are among the most metabolically active tissues in the body. For example, although these tissues collectively never account for more than 6% of body weight, they can be responsible for up to 50% of the whole body turnover of some essential amino acids and between 10 to 20% of whole body energy **[Goudoever et al, 2000 & Reeds, et al, 2001].**

In the late 1970s' the age of viability of newborn was approximately 28 weeks' gestation. Most infants less than 1,000 grams and some less than 1,500 grams were considered nonviable; therefore, resuscitation attempts were less aggressive. Advanced technology has led to improvements in ventilators, intravenous access materials, and surfactant therapy; all of which have an impact on lowering the age of viability. It is not unusual today to resuscitate infants as young as 22 weeks' gestation. One of the major obstacles in the care of these babies is to provide adequate nutritional intake **[Brine et al, 2004].**

While the prevailing thought that the nothing per orum (NPO) procedure minimizes the risk of gasterointestinal complications in the critically ill and preterm infants during the acute phase of illness and post operative recovery phase based on the belief that the newborn was in NPO state inutero, since the majority of fetal nutrition is obtained from the placenta, it was detected that the fetus swallows amniotic fluid which should be appreciated for its metabolic significance and its role in the

development of fetal gut. So, at birth the neonatal gut is an experienced organ that is physiologically active and primed for the activities of food assimilation **[Strodtbeck et al, 2003].** Feeding within the first few days of life is very important to keep the GIT viable to do its function as well as yielding demonstrable benefits such as reduced incidence of sepsis and earlier discharge from hospital **[William, 2000].**

Balancing the risk of enteral feeding with those of parenteral nutrition is not easy. Total parenteral nutrition (TPN) is the intravenous infusion of all nutrients necessary for metabolic requirements and to prevent negative energy and nitrogen balance as well as essential fatty acid deficiency. It is commonly indicated in neonates experiencing prolonged no enteral feeding whatever the reason is **[Brine et al, 2004].** The ability to provide TPN over the past four decades has significantly improved the overall survival of newborns when other options of adequate nutritional support were not possible. Fear of toxicity and metabolic imbalance alerted the clinicians to use TPN with caution, especially in the sickest and most premature infants. An increasing number of practitioners appreciate that this cautionary management has resulted in suboptimal nutritional intake of these infants **[Lemon et al, 2001].** Long-term statistics indicated that a significant percentage of infants born very low birth weight might suffer substantial neurodevelopmental deficits in part attributable to inadequate nutritional support during the neonatal period **[Thureen, et al, 2003].**

Also parenteral nutrition causes babies' intestines to degenerate from disuse making feeding more difficult when they move on to the breast or bottle. While babies are in the womb, they constantly swallow amniotic fluid. Growth factors in the amniotic fluid help the fetal intestine to develop normally. So, an artificial amniotic fluid has been recently developed to stimulate the intestinal growth. The ultimate goal is to help premature babies tolerate full feeding sooner **[Ross, 2003].**

Aim of work

To review the pathophysiology of prolonged no enteral nutrition, the immune function of the gut and its affection with the NPO procedure, the importance of gut priming and the novel solutions done to avoid the consequences of prolonged no enteral feeding on the growth and the immunological status of critically ill neonates.

REVIEW OF LITERATURE

IMMUNE FUNCTION OF THE GUT AND FACTORS AFFECTING IT

Neonates at NICU always manifest sepsis specially who are kept on NPO. This is because one of the most important functions of the gastrointestinal tract is to provide a mechanical and immunological barrier against the introduction of microorganisms and toxins. The gastrointestinal tract contains 70% to 80% of the total body immune tissue **[Cole, 1999].**

The specific adverse effects of luminal starvation are decreased number of antibody producing cells, increased uptake of toxins, impaired immune response to foreign antigens and increased bacterial translocation from gut associated lymphoid epithelium. Bacterial translocation, which is the passage of viable bacteria from the gastrointestinal tract to normally sterile tissues, can be enhanced by essential fatty acid deficiency and protein malnutrition **[Strodtbeck, 2003].**

Several studies suggest that the risk for infection secondary to an impaired gut barrier can be prevented or attenuated by enteral nutrition including substrates such as glutamine. This phenomenon has also been reported in very low birth weight preterms. The investigators attribute the observed decrease in infections to decreased translocation of microorganisms and their toxins [**Dallas et al, 1998 & Neu et al, 1999].**

Shulman et al,1998, noted a reduction in culture proven sepsis and C-reactive protein following early enteral feedings. While the authors acknowledge that this effect may be caused by decreased translocation of bacteria, they also admit that one cannot exclude the effect of intravascular access for parenteral nutrition. In a study done by **Hanson et al, 1990,** the link between bacterial colonization and the development of gut associated lymphoid tissue was shown to be enhanced by enteral nutrition **[Strodtbeck, 2003].**

Machado et al 1994, analyzed both the intestinal tissue samples obtained by autopsy and the clinical records of 39 neonates who died within the first 28 days of life. The intraepithelial lymphocyte numbers and postnatal expansion of gut associated lymphoid tissue were significantly correlated with the pattern of feeding and showed no correlation to either birth weight, gestational age, intrauterine growth, or the presence of neonatal infection.

In a study of infants less than 6 months of age who were on TPN following gastrointestinal surgery, **Okada et al**, **1998** noted that impaired phagocytosis and cytotoxic activity against coagulase negative