Neonatal Section Newsletter

NEONATAL SECTION OF ASPEN

Winter 2022

Letter from the Neonatal Section Chair

Dear Section,

It is really an exciting time in nutrition. However, despite our current efforts, growth, developmental sequela, and morbidities remain a problem for the NICU graduate.

The first thousand days of an infants' life is vital for brain, body, and immune function. ***They require micronutrition beyond calories and protein***, such as choline, vitamin E, DHA/ARA, iron, zinc, selenium, iodine, magnesium and electrolytes to ensure adequate structure and function. Unfortunately, current practices may miss identifying gaps in lipids, minerals, and trace elements, particularly when using donated human milk. Unlike their term counterparts, our patient population gets only fractions of milk volume and can have huge limitations in meeting their needs. ***Calculate beyond calories and protein for your teams***. Critically examine your fortification strategies, highlight new ways to augment these very important nutrients. Start quality projects to amplify the evidence for others and most importantly improve the outcomes of our vulnerable babies.

To get the conversation going, we have a wonderful speaker lined up at our Neonatal Section Meeting in Seattle to discuss selenium – ***Dr. Timothy Sentongo, from The University of Chicago***. As teams, dial in, or come in person-start some important cross talk and kick off new projects!

I look forward to "seeing you" all either in person or virtually in March! ***The ASPEN Neonatal Section Forum is scheduled for Monday, March 28th, 6:15-7:15 pm PST at Clinical Nutrition Week; Seattle, WA. Please also join us on Sunday March 27th from 4:30-5:00pm PST for a presentation on "Feeding and Refeeding Syndrome in Premature Infants."***

It will be my honor at the meeting to hand over the Chair position to Celina Cowan MS, RD, CSPCC, LD, CNSC. Until then, stay safe, network, and share data that matters!!

All my best,

Christina

Christina J. Valentine MD, MS, RD, FAAP
Professor/Neonatologist
Christinavalentine03@gmail.com

Contents

Member Spotlight: Audrey Foster, MS, RD, LDN, CNSC

Margaret Murphy PharmD, BCNSP

What is your current job title and place of work?

Clinical Dietitian III
Children's Hospital of Philadelphia

What is your educational background?

BS in Biology with biochemistry focus from Kutztown University, Kutztown PA
MS Human Nutrition from Drexel University, Philadelphia PA
Sodexo Dietetic Internship with focus in clinical nutrition, Philadelphia PA

How did you get involved in the field of clinical nutrition?

I've been in my current role for about 2 years and at CHOP for close to 7 years. My nutrition career started out in community nutrition. I worked at WIC offices throughout Philadelphia and while I did feel like I was able to help families, there was very little room for professional growth. I always had CHOP on my radar for potential jobs and took a position as a research coordinator for an infant microbiome study. Taking this position solidified that CHOP was the place I wanted to work. There are so many learning and development opportunities. I took a clinical nutrition role as soon as I could. Clinical nutrition is a way to blend my love of science and patient care. I moved around a couple of different clinical nutrition assignments before finding what I really loved with surgery nutrition. I initially worked with NICU graduates and pediatric patients on the surgical floor and clinic. When a NICU position opened on the surgery service I was excited to continue to learn about surgery nutrition and learn NICU nutrition.

What specifically do you do in your current position?

I am a clinical dietitian in the NICU on the surgery service. I attend rounds each morning, then collaborate with the team, caregivers and specialty services to provide nutrition care for our patients. Many of our patients require PN and EN during their NICU course. In addition to team rounds I round on all PN patients with a nutrition support attending. I also round with our intestinal rehab team and bone health team as needed. Education is another important part of my role for new RD's, front line providers and fellows. I have also been learning how improvement framework can be used to track data and develop better processes for improved nutrition care.

Why did you become involved in ASPEN and what are the benefits of being a member?

Being a member of ASPEN gives me access to clinical resources that are crucial for my job. Receiving ASPEN journals in the mail makes it easier to stay up to date with new articles. Membership also provides opportunity for professional development by attending or presenting at ASPEN's annual conference.

What recommendations would you give to someone just starting out in your field?

Seek out a mentor. Admit when you don't know the answer to something. Always look for the data to guide decision making. Ask lots of questions.

What do you hope to accomplish as a part of the new Neonatal Section of ASPEN?

I hope to stay current on infant nutrition research. I also hope to meet nutrition professionals who I can learn from or collaborate with to improve nutrition care.

ASPEN News

- **February Clinical Practice Highlights**
- **Nutrition Practice Shortage Update**
- **Join us for ASPEN's 2022 Nutrition Science and Practice Conference**
    - **The ASPEN Neonatal Section Forum is scheduled for Monday, March 28, 6:15 – 7:15 pm pacific time**
- **PN Product Shortage Management: ASPEN provides recommendations on appropriate dosing of PN nutrients for neonates, pediatric, and adult patients**

Research Updates

The information presented in this newsletter does not constitute medical or other professional advice and should not be taken as such. To the extent that the information herein may be used to assist in the care of patients, this is the result of the sole professional judgement of the attending healthcare professional whose judgement is the primary component of quality medical care. The information presented in these documents is not a substitute for the exercise of such judgment by the healthcare professional.

Human Milk Research Updates

Jennifer Lester, MS, RD, CSP, CSPCC, LDN, CNSC & Melissa Steffy, MS, RD, LD, CNSC

Processing Human Milk to Increase Nutrient Density for Preterm Infants

Study Design: Experimental research study with post-test only control group design

Human milk is the gold standard nutrition for every newborn. An exclusive human milk diet has been well studied as a means of preventing necrotizing enterocolitis. Fortification is necessary to meet the nutritional demands of premature infants. If maternal milk is not available, pasteurized, fortified donor milk is the next best option. Unfortunately, despite adding fortification, pasteurized donor milk does not provide the same nutrient or biologically active molecules as mother's milk. If neither maternal nor donor human milk are available, then preterm formula should be used.

A hyperosmolar feeding has been implicated as a possible risk factor for necrotizing enterocolitis. Lactose contributes the most to the osmolality of human milk. The aim of this study was to concentrate donor milk to have a higher caloric and protein density while avoiding the side effects of high osmolality by precipitating lactose at low temperatures. The investigators speculated that through chilled centrifugation, they could crystallize lactose, reduce osmolality, all while maintaining protein content.

Donated milk was obtained from 2017-2019 from the WakeMed Mother's Milk Bank, Cary, NC, a HMBANA (Human Milk Banking Association of North America) milk bank. The milk that was collected was not suitable for infant feeding but was appropriate to be used in the study. Thirty-six samples (N=36) underwent different levels of homogenization, evaporation, and centrifugation to achieve a human milk concentrate that was low in lactose. Volume reduction was represented as condensation and categorized into six levels (80%, 60%, 50%, 40%, 30%, 0%). Once homogenized and condensed, the samples were stored frozen overnight. Next, they underwent refrigerated centrifugation for lactose removal at 0°C. A lactose pellet was removed from the sample and supernatants were separated and compared to the composition of controls.

Results revealed a significant reduction of lactose (S_w= *-262, p<.0001)* and osmolality (S_w= *-211.5, p<.01)* in the concentrated milk without a significant loss of protein during centrifugation (S_w = *-44.5, p = .49)*. The average protein content for the samples increased as the condensation levels increased.

Thus lactose removal did not cause a significant protein loss between control and supernatant. Protein and osmolality both increased as volume reduction increased. The 30% volume reduction level had an osmolality less than the AAP (American Academy of Pediatrics) recommendations for maximum osmolality.

There is marked variation in the composition of human milk. The authors did not collect information about the donors, stage of lactation, or time of day the milk was collected. Since the lipid content of the milk was not tested, the caloric density of the milk was undetermined. Despite these limitations, the investigators found that concentrating human milk can increase the concentration of micronutrients, protein, and lipid while avoiding hyperosmolality. This method is advantageous because other volume reduction methods, like ultra-filtration, can void milk of its bioactive molecules. Therefore, this process might be a simple and low-cost way to achieve a product with higher nutrient density.

Ulus HZ, Tekbudak MY, Allen JC. Processing Human Milk to Increase Nutrient Density for Preterm Infants. Journal of Human Lactation. November 2021. doi:10.1177/08903344211056933

Pasteurized Donor Human Milk Should Not Replace Mother's Own Milk in Preterm Neonates: A Quality Initiative Toward Decreasing the "PDHM Dependency"

Study Design: Quality Improvement Initiative

Mother's own milk (MOM) is the preferred source of neonatal nutrition, but due to various challenges in the NICU, pasteurized donor human milk (PDHM) is often needed as a supplement. Although PDHM is a wonderful resource for preterm infants, the use of PDHM may result in a reduced drive to express and utilize MOM. The aim of this quality improvement initiative was to address the issue of "PDHM dependency" of mothers and staff and improve the contribution of MOM to more than 90% daily intakes for preterm infants <32 weeks gestation admitted to the NICU.

The study was conducted in three phases: observation phase (6 weeks), intervention phase (6 weeks), the maintenance phase (6 months). During the observation phase various causes were identified that led to PDHM dependency and a bundle of best practices were developed. Some of the best practices included the creation of a multidisciplinary team to provide regular counseling to parents on the importance of MOM, a comprehensive exclusive breastfeeding protocol, which focused on first feed as MOM, teaching on milk expression and availability of breast pumps and maintaining daily logs of milk expression, MOM/PDHM intakes and kangaroo care. The practice modifications were implemented during the intervention phase using Plan-Do-Study-Act cycles. Outcome measures were collected and included daily intakes of MOM/PDHM, type of first feed, hours of life at first feed, percentage of infants on MOM at discharge, length of stay (LOS) and growth parameters. Data collected during the maintenance phase was atypical due to impact of coronavirus pandemic and was not included in the analysis.

The results showed that during the observation phase, the proportion of MOM used was 74.4% and PDHM was 20.5%. During the intervention phase, the proportion of MOM increased significantly to 93.5% and PDHM decreased to 4.6%. Hours of life when first feeding was started was significantly improved from 11 hours to 5 hours and mean days to regain birth weight was lower (11.9 versus 15.5) in the intervention phase compared to observation phase. The remaining growth parameters, LOS and percentage of infants on MOM at discharge were comparable between both groups.

While PDHM has become a second-best choice when MOM is not available, it is important that it not become a replacement for MOM. NICUs should invest in resources that address lactation barriers to improve the supply of MOM. This study shows that regular counseling and involvement of mothers may help to decrease PDHM dependency.

Bagga N, Kurian S, Mohamed A, Reddy P, Chirla DK. Pasteurized Donor Human Milk Should Not Replace Mother's Own Milk In Preterm Neonates: A Quality Initiative Towards Decreasing the "PDHM Dependency" Breastfeed Med. 2021;10.1089/bfm.2021.0155.doi:10.1089/bfm.2021.0155.

Supplemental Nutrition Research Updates

April Church MS, RD, LD, CNSC

Fat Supplementation of Human Milk for Promoting Growth in Preterm Infants

Study Design: Intervention Review

Preterm infants are at risk for postnatal nutritional deficits resulting in inadequate growth and development. Preterm infants require higher fat intake than term infants for adequate growth and development. Insufficient consumption of fat can adversely affect growth, immune development, neurological function, gastrointestinal function, and visual acuity. This study aimed to complete a literature review to determine if supplementation of human milk with additional fat from commercial modular products, such as Microlipids™ and medium chain triglyceride oils, compared to human milk without supplementation fed to preterm infants would improve growth, body composition, cardio-metabolic and neurodevelopment outcomes. This 2020 review was to update the last Cochrane Review published in 2000 which reported no clear benefit or harms of fat supplementation of human milk in preterm infants. Selection criteria included published and unpublished randomized controlled trials using random or quasi-random methods to allocate preterm infants fed human milk in hospital to supplementation or no supplementation with additional fat.

Unfortunately, limited results were noted and only one randomized trial with 14 preterm infants <32 gestational weeks and birth weight <1500 grams could be included. The infants were to receive 1 g human milk fat per 100 ml of human milk or no supplementation. The overall quality of evidence was deemed to be of very low quality. There was no clear benefit with the additional fat supplementation on in-hospital growth rates with regards to weight, length, and head circumference. There was also no evidence that additional fat resulted in increased feeding intolerance. There was no data available on the effects of fat supplementation on the risk of necrotizing enterocolitis or neurodevelopmental outcomes.

The authors concluded that limited data with only one very low-quality evidence trial (small sample size n =14, few events, and low precision) that the results may not truly reflect the short-term and long-term outcomes of fat supplementation of human milk in preterm infants. Future high-quality research is needed to determine to potential benefits and/or harm of additional fat added to human milk in preterm infants. The authors also note that future high-quality trials are needed to help identify the proper delivery method, amount and composition of extra fat required, and the potential side effects.

Amissah EA, Brown J, Harding JE. Fat supplementation of human milk for promoting growth in preterm infants. Cochrane Databse of Systemic Reviews 2020. Issue 8.Art.No.: CD000341. DOI: 10.1002/14651858.CD000341.pub3.

Parenteral Nutrition and Shortages Research Updates

Alyssa Tucker, MS, RD, LD, CLC, CSNC & Amber V. Pulido, PharmD, BCPS, BCNSP

Recommendations for Photoprotection of Parenteral Nutrition for Premature Infants: An ASPEN Position Paper

Study Design: Position Paper

When lipid injectable emulsions (ILE) and PN admixtures are exposed to light they are susceptible to degradation, including oxidation when in the presence of oxygen. Previous research has shown that vitamins and polyunsaturated fatty acids contained within ILE are the most susceptible to degradation. Preterm infants are at higher risk of the negative outcomes associated with oxidative stress than children and adults. Oxidative stress in preterm infants can contribute to development of bronchopulmonary dysplasia (BPD), retinopathy of prematurity (ROP), and necrotizing enterocolitis (NEC). This position paper provides recommendations for photoprotection of PN and ILE in order to help mitigate the production of free radicals within these mixtures.

Sunlight, phototherapy used for hyperbilirubinemia, and ambient light are all examples of light that is exposed to ILE and PN. It was found that light exposure during storage, compounding, delivery and/or infusion can alter the admixture stability, therefore photoprotection is recommend. Due to current product availability, ASPEN acknowledges that complete photoprotection may currently not be feasible. However, some recommendations for limiting of light exposure include amber lighting when compounding in the pharmacy, minimizing natural light, or amber overwrap bags. Healthcare institutions should evaluate their current processes and pinpoint areas in which further photoprotection can be achieved and implement those strategies.

Robinson DT, et al. Recommendations for photoprotection of parenteral nutrition for premature infants: An ASPEN position paper. Nutr Clin Pract. 2021 Oct;36(5):927-941. doi: 10.1002/ncp.10747. Epub 2021 Sep 1. PMID: 34472142.

Effect of Selenium-Free Parenteral Nutrition on Serum Selenium of Neonates and Infants Maintained on Long-Term Parenteral Nutrition

Study Design: Retrospective cohort study

In South Korea where this study was conducted, intravenous (IV) selenium is difficult to obtain and deliver to PN-dependent patients. ASPEN recommends a standard dose of 2 mcg/kg/day of selenium for pediatric patients. The authors sought to examine the impact of their NICU's current selenium practice, in which IV selenium is administered at 2 mcg/kg/day only upon identification of low serum selenium levels at 4 weeks or longer of selenium-free PN.

The authors examined 102 infants admitted to the NICU who received PN for at least 2 weeks, had at least one selenium level documented, and did not receive IV selenium until after a baseline serum selenium was collected. A subgroup analysis was also conducted of the patients who received IV selenium for at least 1 week with a follow up level. Normal serum selenium levels were defined as 50 – 150 mcg/L.

Patients were categorized as selenium deficient vs. selenium sufficient, and these two groups were compared. The selenium deficiency rate was 53.9%, including 58.4% of preterm patients and 40% of term patients. Bronchopulmonary dysplasia was statistically more common in the selenium-deficient group (60% vs. 40%, p= 0.049). Twenty-nine patients met criteria for the subgroup analysis comparing baseline and follow up serum selenium levels. Among preterm infants (n = 20), the serum selenium level changed from 32.9 ± 16.1 mcg/L to 48.1 ± 20.2 mcg/L. Among term infants (n = 9), the serum selenium increased from 44.7 ± 20 mcg/L to 62.2 ± 12.6 mcg/L. The average dose of IV selenium which achieved these trends was 2.7 ± 1 mcg/kg/day.

According to the authors, the rate of selenium deficiency was comparable to previously reported values in the United States (59.1-66.7%). This data also suggests that a standard 2 mcg/kg/day of selenium supplementation may not always be enough to avoid deficiency, especially in preterm neonates. A dose of 4 mcg/kg/day may be needed to reverse a selenium deficiency that has already occurred.

These findings are limited by the possibly unique difficulty delivering IV selenium in South Korea vs. other countries, such that the studied patients were more deficient than neonates receiving some selenium in their PN for the first few weeks of therapy. The results are also limited by the retrospective nature of the data and relatively low sample size and power. The authors conclude that early and regular monitoring of serum selenium levels are warranted to prevent deficiency, and that selenium doses should be adjusted based on serum concentration, rather than relying on a standard 2 mcg/kg/day dose.

Lee JiY, Shin HJ, Bae HJ, et al. Effect of selenium-free parenteral nutrition on serum selenium of neonates and infants maintained on long-term parenteral nutrition. Journal of Parenteral and Enteral Nutrition. 2021; 1-9.

GI Research Updates

Jacqueline Wessel RDN, CNSC, CSP, CLE & Audrey Foster MS, RD, LDN, CNSC

Mucous Fistula Refeeding Promotes Earlier Enteral Autonomy in Infants with Small Bowel Resection

Study Design: Retrospective Cohort Analysis

Infants who require intestinal resection from necrotizing enterocoloitis (NEC) or small bowel atresia (SBA) may benefit from mucous fistula refeeding (MFR). Some of these benefits include nutritional absorption and growth as well as intestinal adaptation. This study compared clinical outcomes among infants with an enterostomy and mucous fistula (MF) with and without MFR. This center reviewed their patients over a 9 year period, 101 patients were analyzed. Seventy-five neonates had NEC and 26 had SBA. Of those patients, 64% had received MFR: 60% of the NEC patients, and 77% of the SBA patients. The median duration of MFR in NEC patients was 25 days, and 31 days in SBA patients. Among the patients in the MFR group, none experienced complications, clinical decompensation, or infection attributed to the refeed.

Infants in both groups had significantly less parenteral nutrition associated liver disease (PNALD) compared to those not fed through the mucous fistula. Those with NEC who underwent MFR achieved full enteral feeds 13.6 days sooner after the next intestinal reconnection surgery than the non-MFR group ($p = 0.011$), had 22.8 fewer days of TPN, ($p \leq 0.001$), and 22 fewer central line days ($p = 0.007$). Weight gain between surgeries was higher in the MFR vs non-MFR group ($P = 0.13$), and although non-statistically significant, there was improvement in weight, head circumference, and length z-score at discharge. The SBA patients that received MFR vs non-MFR also had a lower peak bilirubin ($p = 0.04$). The SBA patients also had improved z-score for weight by 0.91 $P = 0.049$ at the time of the next surgery for intestinal take down and at discharge.

This study demonstrated advantages to MFR, including improved weight gain during the period of MFR, decreased TPN duration, and lower incidence of PNALD. Due to the greater number of NEC patients, statistical significance was seen, whereas the SBA patients showed similar results, but without statistical significance. Although the small sample size was a limitation to this study, when compared to other literature studying MFR, this study has one of the largest groups reported.

Cincinnati Children's Hospital has been using this technique for > 20 years and has an algorithm and order set in place. Documentation of MFR is challenging. Changes to the electronic medical record must be made so that MFR are not counted into the "first pass" enteral feeds which would double count enteral intake. In addition, guidelines that outline who can replace the mucous fistula feeding tube and how to manage these feeds are important to establish. To prevent dislodgements, the tube is sutured and if possible, the mucous fistula tube is tunneled. Education regarding these feeds is important from the bedside nurse caring for the tubes, to the providers writing the orders, and the

surgeons placing the tubes. When proper education is done, this can be helpful to maximize safe enteral intake in these infants.

Woods SD, McElhanon BO, Durham MM, et al. Mucous Fistula Refeeding Promotes Earlier Enteral Autonomy in Infants with Small Bowel Resection. JPGN 2021, 73:654-658.

Achieving Adequate Growth in Infants with Congenital Diaphragmatic Hernia Prior to Discharge

Study Design: Retrospective observational study

Infants with congenital diaphragmatic hernia (CDH) are born with a defect in their diaphragm, which allows for abdominal organs to migrate above the diaphragm and develop in the chest cavity. Infants with CDH are supported with parenteral nutrition until after surgical repair. The presence of cardiac or pulmonary comorbidities, along with gastroesophageal reflux disease (GERD), often require volume restrictions that lead to reduced calorie intake. However, it is important to optimize nutrition provision for these infants who are at high risk for malnutrition. The purpose of this study was to evaluate the growth of CDH infants who received fortified human milk compared to those who received formula.

The authors of this study extracted data from the electronic health record of CDH patients at a single institution who were born between 2017 and 2019. Weight-for-length z-score at discharge was used to indicate malnutrition for this study. Of the 149 infants included in the study, 46% met criteria for malnutrition at discharge from their initial hospitalization for CDH repair. Most infants received human milk as their source of nutrition at discharge and about 50% of those infants received fortification of human milk. Infants fed human milk received an average of 22 ± 2.3 kcal/oz versus 24 ± 2.2 kcal/oz in formula fed infants. Infants who were formula fed had lower weight-for-length z-scores than the infants fed human milk. Infants who received fortification earlier in their hospitalization had higher weight-for-length z-scores at discharge when compared to later fortification. GERD was a common problem identified in this cohort of CDH infants. GERD was associated with a longer hospital length of stay and with formula feeding. Based on this data, the authors recommend the use of human milk and proactive fortification to prevent inadequate weight gain.

Wild KT, Bartholomew D, Edwards TM, et al. Achieving adequate growth in infants with congenital diaphragmatic hernia prior to discharge. J Pediatr Surg. 2021;56:2200-2206. doi.org/10.1016/j.jpedsurg.2021.03.048

Social Media Update

Leah Cerwinske, MSN, RDN, LDN, CNSC

Hello neonatal nutrition enthusiasts! Have you been keeping up the NICU conversations and questions going on for our social media group? The neonatal section of ASPEN has two accounts (Facebook: https://www.facebook.com/groups/aspenneonatalsection/ and Member Connect: https://memberconnect.nutritioncare.org/) to provide you with information. Our goal, as always, is to provide up-to-date information and practical suggestions for clinical practice based on the latest research and expert experience. If you have ideas or feedback for the social media committee, WE WANT TO HEAR FROM YOU! Please contact Leah Cerwinske at lcerwins@gmail.com with any feedback or interest in committee involvement. We need more volunteers to help with social media, so don't hesitate to reach out if interested.

Neonatal Continuing Education Opportunities

Jennifer Wax, RD, LDN, CNSC

Neonatal Nutrition Conference - Baylor College of Medicine/Texas Children's (virtual)
Date: March 7th-9th
Contact: Jana Unger 832-826-7991
jpunger1@texaschildrens.org

ASPEN 2022 Nutrition Science & Practice Conference (in-person and virtual)
Location: Seattle Washington
Date: March 26th-29th

- The ASPEN Neonatal Section presentation, "Feeding and Refeeding Syndrome in Premature Infants," is scheduled for Sunday, March 27th, 4:30pm – 5:00pm PST; CE available for event!
- The ASPEN Neonatal Section Forum is scheduled for Monday, March 28, 6:15 – 7:15 pm PST; CE available for event!

Register at nutritioncare.org
Advance rate ends 3/9/22

Neonatal Section Member Spotlight and Accomplishments

We want to hear from you! The ASPEN Neonatal Section group is proud of the many accomplishments of our members and we'd like to highlight what you're doing. If you have any feedback or ideas, noteworthy awards, presentations, published research, or projects that you'd like to share with our members please let us know by contacting the section group newsletter editor Sabrina Bierman (sabierman02@gmail.com).

Rhoads Research Foundation

Please consider donating to Rhoads Research Foundation. This Foundation is named in the honor of Dr. Jonathan Rhoads, M.D. for his outstanding and pioneering work in the fields of clinical nutrition, nutrition support and surgery. Through its annual grants program, the Foundation funds exceptional scientific research projects submitted by early career investigators of clinical nutrition and metabolic support in alignment with the priorities in ASPEN's research agenda. No matter how much you are able to contribute in these economic times every dollar collected is greatly appreciated. If you contribute please just follow this link. Rhoads Research Foundation Donations

Section Chair- Christina Valentine
Christinavalentine03@gmail.com

Newsletter Editor- Sabrina Bierman
sabierman02@gmail.com