RDs In Practice: Advancing Practice in Pediatric Nutrition
Supporting the Pediatric Intensive Care Patient

Round Table:
Medication Management- Grace J. Lee, PHARM. D., BCPS

Program Objectives:
Upon completion of this round table, participants should be able to:

1. Recognize common ICU medications that can cause electrolyte disturbances and how to adjust for them in the TPN
2. Explain the controversy surrounding early enteral feeding in an ICU patient on vasopressors
3. List patient risk factors to consider when deciding whether early enteral feeding is appropriate

References:
Buckley M, LeBlanc J, Cawley M. Electrolyte disturbances associated with commonly prescribed medications in the intensive care unit. Crit Care Med 2010 38(6): S253-S264

Heighes Pt, Doig GS, Sweetman EA, et al. An overview of evidence from systematic reviews evaluating early enteral nutrition in critically ill patients: more convincing evidence is needed. Anaesth Intensive Care 2014; 38:167-74

Khalid I, Doshi P, DiGiovine B. Early enteral nutrition and outcomes of critically ill patients treated with vasopressors and mechanical ventilation. Am J Crit Care 2010;19:261-8

Marik P. Enteral nutrition in the critically ill: myths and misconceptions. Crit Care Med 2014; 42: 962-969

Preiser, JC, van Zanten ARH, Berger MM, et al. Metabolic and nutritional support of critically ill patients: consensus and controversies. Critical Care 2015; 19:35

Revelly JP, Tappy L, Berger MM, et al. Early metabolic and splanchnic responses to enteral nutrition in postoperative cardiac surgery patients with circulatory compromise. Intensive Care Med 2001;27: 540-7.

Turza KC, Krenitsky J, Sawyer RG. Enteral feeding and vasoactive agents: suggested guidelines for clinicians. Practical Gastroenterology. Sept 2009. Accessed on July 2015 http://www.medicine.virginia.edu/clinical/departments/medicine/divisions/digestive-health/nutrition-support-team/practical-gastro 2009

TPN guidelines, CHOC Children’s Hospital
TPN guidelines, Seattle Children’s Hospital

Use of Honey for Wound Care

The type of honey used for therapeutic effect in wound care is derived from a Tea tree grown in New Zealand called Leptospermum scoparium (Manuka). This medical grade honey is filtered, gamma-irradiated, and produced under carefully controlled standards of hygiene to ensure the standardized production of honey. All botulism spores and microscopic particles are removed.

Effects of Honey on Wound Healing:

Debridement - The high sugar/low water content in honey, via osmosis, draws lymph fluid from deeper tissue. As a result the fluid is continuously bathing the wound in fluids that contain enzymes which break down the fibrin tethers that adhere slough and eschar to the wound bed.

Wound infection - Honey creates an acidic pH of 3.2 – 4.5, where bacteria cannot thrive and bacterial growth is inhibited. It also contains an enzyme called glucose-oxidase that stimulates the release of hydrogen peroxide on contact with body tissues.

Adverse Reactions:

- Transient stinging
- Adverse reactions such as anaphylaxis or systemic toxicity (i.e. hyperglycemia in diabetic patients) has not yet been reported

Contraindications:

Patients with allergy to honey or bee products, including bee stings

Clinical Trials:

Reference	Study Design	# of Articles Patients Reviewed/Studied Treatment Regimen	Study Limitations	Summary of Results
Gethin G et al. J of Clinical Nursing 2008; 18: 466-74 & J of Wound Care 2008; 17: 241-6.	Prospective, multi-center (10 sites), open label, randomized, controlled trial	▪ Manuka honey (MH) 5 g/20 cm^2 *vs* hydrogel (HT) 3 g/20 cm^2 for 4 weeks and followed up at week 12 ▪ Compare desloughing efficacy and healing outcomes in venous leg ulcers in patients with ≥50% wound covered with slough	▪ Did not enroll enough patients to reach power of study	▪ 80% wounds had >50% reduction in slough at 4 weeks, but no difference between groups (67% MH *vs* 52.9% HT). Mean wound covered in slough reduced to 29% in MH group *vs* 43% in HT group. ▪ Significant reduction in wound size in MH group (34% *vs* 13%; p=0.001) at 4 weeks ▪ At 12 weeks, 44% MH vs 33% HT wound healed

		▪ 156 patients required to show a 20% difference in with 80% power at 5% 2-sided significance level ▪ 108 adult patients enrolled, 54 in each group ▪ 35 males, 73 females, aged 24-89 years (mean 68)		▪ Infections developed in 6 MH *vs* 12 HT patients ▪ Baseline MRSA: 10 in MH *vs* 6 in HT, after 4 weeks, 7 (70%) in MH *vs* 1 in HT (16%) eradicated ▪ Baseline Pseudomonas aeruginosa: 6 in MH *vs* 10 in HT, after 4 weeks, 2 (33%) in MH *vs* 5 (50%) in HT eradicated ▪ No adverse events identified
Bardy J et al. Journal of Clinical Nursing 2008; 17: 2604-23. (Oncology)	Review article	▪ 43 total studies reviewed ▪ 5 of which were oncology ▪ 1 of which was pediatric oncology (see Simon article below for details)	▪ Small sample sizes ▪ Lack of randomization ▪ Absence of blinding	▪ Honey promoted wound healing and cleared infection (Cavanagh and Simon) ▪ Honey decreased severity and duration of radiation-induced oral mucositis and prevents weight loss (Biswal) ▪ Honey is effective for oral mucositis, stomatitis, malignant ulcers and infected lesions (Cavanagh) ▪ Honey reduced microbes in oral cavity of head and neck cancer patients (Sela)
Simon A et al. Support Care Cancer 2006; 14: 91-7. (Oncology)	Observational, non-comparative study	Clinical experience at Children's Hospital, University of Bonn over 3 years ▪ 13 oncology pediatric ▪ 2 oncology adult ▪ 1 hematology pediatric Pediatric patients ages 2-17; many of whom had cultured pathogens	Survey only of effectively managed wounds using Medihoney	Successful, uncomplicated wound healing in pediatric oncology patients, within 5-36 days of using honey (except two cases in 52 and 72 days)
Bell SG. Neontal Network 2007; 26: 247-51.	Review article	Two neonatal articles reviewed: ▪ One using honey to treat wound infections in neonates (Vardi)	▪ Small sample sizes ▪ No comparison groups ▪ No randomization	▪ Honey appears to be safe and useful in treating difficult to heal infected wounds ▪ Double-blinded randomized controlled clinical trials are still needed ▪ Honey is recommended for wound care, not

		▪ Another to treat diaper dermatitis in infants (Al-Waili). (See articles below for details)		for consumption
Vardi A et al. Acta Paediatr 1998; 87: 429-32. (Neonatal)	Observational, non-comparative study	Nine infants with large, open, infected post-surgical wounds that failed to heal after >14 days of conventional treatment ▪ 8 male ▪ 1 female ▪ Weight: 1.84-6.9 kg	▪ No comparison ▪ Small sample ▪ Convenience sample	▪ All wounds were closed and sterile within 21 days of topical honey ▪ No systemic adverse reactions were noted, specifically hyperglycemia, electrolyte imbalance or C. botulinum cultures ▪ Honey is safe and effective in post-op wound infections, which do not respond to local & systemic conventional treatments
Al-Waili NS Clin Microbial Infect 2005; 11: 160-3. (Neonatal)	Pilot study Randomly selected if baby had diaper dermatitis	▪ 8 boys ▪ 4 girls ▪ Ages 3-18 months ▪ 4 cultured positive for Candida Albicans ▪ Treatment mixture contained honey, olive oil and beeswax applied 4x/day x 7 days by parents ▪ Rash severity (lesion score)was scored on 5 point scale at baseline, 3,5, and 7 days	▪ Small sample size ▪ Absence of blinding	▪ The mean lesion score declined significantly ($p<0.05$) at 3 days and continue to decline on days 5 and 7. ▪ By day 7, 10 of 12 infants had mild or no diaper dermatitis. ▪ 2 of the 4 patients with positive C. albicans were negative by end of treatment ▪ No adverse effects were recorded ▪ Parents reported easy to apply treatment and tolerated well

Current Treatment Modalities at CHOC Children's:

Debridement:	Santyl (collagenase - enzymatic debrider)
Infected wounds:	Iodosorb gel; silver dressing. (Note: Iodosorb cannot be used in patients with allergies or reactions to Iodine and should be used with caution due to concerns of the systemic absorption of Iodine on thyroid function.)

The advantage of honey dressing is that it can be used on wounds that are infected and also require debridement. Therefore, facilitation of wound healing can be achieved with fewer products.

Cost Comparison:

Santyl (collagenase)	30 g tube	$72.38/tube
Iodosorb	10 g tube	$11.01/tube
ManukaPli Honey	15 g tubes	$5.25/tubes
Acticoat Flex (silver)		$12.90/sheet
ManukaTek (honey)		$6.19/sheet

Patient Label

Honey Dressing Data Collection Form

Patient Population: NICU PICU CVICU ONC/OICU Med/Surg

Type of wound: IV extravasation Pressure ulcer Surgical Other: _____

Honey being used instead of: Silver dressing Santyl Other: _____

For IV extravasation, were the following used for treatment by MD prior to Wound Care Consult (circle one)?

None Hyaluronidase (Amphadase, Vitrase aka Wydase) Nitroglycerin

Outcomes:

Date	***Base-line***											
Wound (cm)												
% devitalize tissue												

Please document baseline wound measurement and wound measurement with every dressing change but at least every 3 days

Total days to wound healing: _____ days

Switch to other treatment modalities Yes No If yes, list treatment: _____

Infection during treatment Yes No If yes, list infection: _____

Adverse Reactions:

None Hyperglycemia Local reactions (redness, erythema) Pain Other: _____

Was honey dressing discontinued because of adverse reactions? Yes No

For NICU patients:

Date/Time	***Base-line***											
Glucose level												
Time of dressing change												

Please document baseline glucose level (pre-honey treatment) and glucose levels after every dressing application. If multiple glucose levels, record level closest to time of application of dressing

Other causes of hyperglycemia: Yes No If yes, list other causes: _____

Please return completed forms to "Honey Data Collection Form" folder in Kim's mailbox