

Mothers' "Liquid Gold": A Quality Improvement Initiative to Support Early Colostrum Delivery via Oral Immune Therapy (OIT) to Premature and Critically Ill Newborns

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Abstract

Early breast milk, known as colostrum ("liquid gold") provides immune benefits to infants, offering potential risk reduction for nosocomial infection (NI) and necrotizing enterocolitis (NEC), a serious gastrointestinal emergency. Provision of colostrum is recognized as oral immune therapy (OIT) and is valuable to all NICU infants unable to feed orally. A quality improvement project was initiated by the multidisciplinary NICU Quality Care Council at London Health Sciences Centres-Victoria (LHSC-VH) to obtain mothers' colostrum for early OIT. The initiative was driven by the Canadian EPIQ (Evidence-based Practice for Improving Quality) group as a means of reducing the rates of NEC and NI, two major morbidities in the NICU. The overall aim was to facilitate the availability of OIT to preterm and critically ill neonates as soon as possible after birth.

Introduction

A quality improvement project was initiated by the multidisciplinary NICU Quality Care Council at the London Health Sciences Centre – Victoria Hospital (LHSC-VH) that aims to provide colostrum to preterm and ill infants who are unable to receive oral feeding. It involves the implementation of oral immune therapy (OIT) as an alternative route of administering mothers’ “first milk” to vulnerable infants in the Neonatal Intensive Care Unit (NICU). This initiative was driven by recommendations from the Canadian EPIQ-II (Evidence-based Practice for Improving Quality) network as a means of decreasing the incidence of necrotizing enterocolitis (NEC) and nosocomial infection (NI) in medically fragile neonates (EPIQ-II 2013).

Colostrum is produced by a woman’s mammary glands in late pregnancy and provides baby’s first milk for up to three to four days after birth. Colostrum is rich in protein and lower in fat than regular breast milk. It contains antibodies that protect the newborn against disease, and for this reason is recognized as an immune therapy (Newburg and Walker 2007). The immune factors unique to preterm colostrum last throughout the first weeks of life and, therefore, provide much-needed immune protection when these infants are at highest risk for infection (Araujo et al. 2005; Mathur et al. 1990; Montagne et al. 1999). Early provision of mothers’ breast milk is thought to reduce the risk of necrotizing enterocolitis, an inflammatory and infectious condition of the bowel, which may result in the death of intestinal tissue. NEC most often affects preterm, very low birth weight (VLBW) or sick babies and is one of the leading causes of death among this vulnerable population (Edmond and Bahl 2006).

Typically, preterm and critically ill infants are too immature or fragile to breastfeed. Nutrition is provided enterally via a nasogastric (NG) feeding tube. Mothers are encouraged to express breast milk, which can be administered through the NG tube. Although mothers aspire to bond with their babies through breastfeeding, it should be recognized that attachment and nurturing are still achieved by a mother providing this nutrient-rich substance for her newborn, no matter how it is given. Unfortunately, because of the nature or degree of the infant’s illness and immature digestive system, our ability to provide colostrum safely through an NG tube may also be restricted. In this case, it is proposed that a small amount of the mother’s own milk, administered orally, may offer the safest alternative (Rodriguez et al. 2009). OIT involves placing small amounts of colostrum directly onto the oral mucosa, with the expectation that selected components (human milk oligosaccharides and cytokines) found in colostrum will be absorbed by the mucous membranes in the oral

cavity and upper respiratory tract (pharynx). This route of administration may provide a local barrier of protection based on the ability of these specialized immune components to block the adhesion of pathogens onto epithelial cells, thereby preventing NI and secondary ventilator-associated pneumonia in this high-risk population (Andersson et al. 1986; Coppa et al. 2006).

The overall purpose for introducing the Liquid Gold initiative at LHSC-VH was to formalize the delivery of OIT to preterm and critically ill neonates. The core team involved in this process included a neonatologist, neonatal nurse practitioner (NP), clinical educator, lactation consultant, staff nurse and registered dietitian. Ad hoc members from the Obstetrical Care Unit (OBCU) and Mother Baby Care Unit (MBCU) were also involved at various stages throughout planning and implementation.

The role of perinatal healthcare professionals is critical in providing families with the most accurate information to support their decision regarding breastfeeding. As NEC represents one of the most devastating and resource-intensive illnesses affecting preterm babies, it is imperative that healthcare professionals provide information to mothers regarding the immune properties inherent in colostrum (California Perinatal QCC 2008). Offering fundamental knowledge in terms of the benefits of breast milk may encourage mothers to express for their preterm infants. The success of this program depends upon a multidisciplinary, family-centred approach to supporting mothers in providing this vital nutrition and immune protection for their babies (Meier 2003; Meier and Engstrom 2007; Miracle et al. 2004).

Background

Studies in both animal models and human adults involving the delivery of various immune factors found in colostrum given via the oral mucosal route have demonstrated a benefit to overall systemic immune activity (Andersson et al. 1986). Although OIT is in the early stages of research with regard to outcome measures, it is actively being studied for tolerance and safety. In fact, a recent pilot study using oropharyngeal administration of 0.2 mL q2h of colostrum to extremely low birth weight infants demonstrated a high level of tolerance (Rodriguez et al. 2010).

While continued OIT intervention trials will be important to confirm the clinical benefits, many studies have already confirmed a dose-related effect between mothers' own milk and risk reduction of NEC and NEC-related deaths in VLBW infants (Lucas and Cole 1990; Meinzen-Derr et al. 2009; Sisk et al. 2007).

Given the documented safety of OIT and the dose-related effects of expressed breast milk, a secondary goal of early colostrum delivery is increased rates of “exclusive” breast milk feeding during and following hospitalization. A recent multi-centred quality improvement initiative successfully increased breast milk delivery to VLBW infants after launching an educational breastfeeding campaign (Ward et al. 2012).

The indisputable health benefits of breastfeeding merit the cooperation and coordination of perinatal healthcare staff to educate and encourage women and their families to choose breastfeeding (AAP 2012; ACOG 2013; Pound and Unger 2012). The provision of mothers’ own milk is especially crucial for preterm and critically ill infants and is used as an effective strategy for reducing neonatal morbidity and mortality rates in the NICU.

Design and Implementation

The Plan-Do-Study-Act (PDSA) model for improvement was used as the theoretical framework for designing and implementing the Liquid Gold initiative (Langley et al. 2009). Collaboration with the LHSC Perinatal Program involved creating new practice guidelines, revising documentation forms and planning education and communication strategies.

The impact of this initiative depends on early and ongoing educational support to mothers. The antenatal consultation process between expectant parents and the neonatal team has always included a discussion regarding the benefits of providing colostrum and breast milk to preterm babies. A parent education handout, “Babies Need Their Mother’s Milk,” now enhances this consultation and offers parents the opportunity to make an informed decision.

When a baby is admitted to the NICU, an additional handout, “What Is Colostrum?” prompts the nurse to provide instructions to mothers on how to collect colostrum and provide OIT for their babies. Mothers are empowered to take an active role in record-keeping, documenting their breast milk expression schedules and volumes obtained. In this way, mothers are active participants in providing care for their baby.

To facilitate safe identification, handling and storage of colostrum, breast milk labels and colostrum collection kits containing sterile syringes and caps are made available to mothers soon after birth. Mothers are responsible for collecting and labelling their breast milk. Our bar-code scanning system, Women and Infants®, was reprogrammed to allow direct scanning of freshly expressed

breast milk. This patient identification system ensures safe coupling between the mother and her infant.

Preprinted medical order forms currently include OIT orders for all infants unable to feed orally unless breast milk is contraindicated for medical reasons. This practice ensures that all eligible infants admitted to the NICU have the opportunity to benefit from “liquid gold.”

Education

The success of the Liquid Gold initiative is dependent upon a comprehensive education program offered to all healthcare professionals involved in the care of mothers and infants. Formal education sessions were provided weekly on day and evening shifts, from July through October 2012. Although nurses were the targeted audience, education sessions were open to all disciplines. The 30-minute sessions were taught by the NICU clinical educator and lactation consultant. Content included pathophysiology of NEC/infection in VLBW infants, clinical research supporting the benefits of mothers’ own milk, the protective factors of colostrum and the safety and efficacy of OIT administration. A short video clip illustrating manual expression of breast milk was shown, and hands-on training using a breast simulator reinforced proper technique. A self-directed online teaching program addressed learning needs of staff unable to attend scheduled education sessions.

Advertising the Liquid Gold initiative included newsletters, online education updates, posters, bulletin board displays, informal group discussions and regular agenda items at Quality Care Council meetings.

Research

Objectives

1. To ensure that all infants in the NICU who are unable to feed orally will receive expressed mother’s own milk within six hours of delivery via OIT.
2. Mothers will develop a sense of empowerment as they collect, organize and administer breast milk to their baby.
3. Mothers of infants admitted to the NICU will achieve an increased milk supply through early initiation, instruction and support of hand expressing and pumping.
4. Initiation of OIT and early expression is expected to increase exclusive use of mothers’ own milk for infants admitted to the NICU.
5. Increasing mothers’ own milk given to preterm infants in the NICU will result in decreased incidence of NEC and NI, especially in VLBW infants.

Data collection and EPIQ-II

In order to study the outcomes of this initiative, baseline data were collected on 30 consecutive NICU admissions that met the criteria for OIT. Charts were audited for (a) time of expressing first milk, (b) time of baby's first OIT dose and (c) exclusivity of breast milk feeding at discharge. This data will be analyzed in comparison to data from 30 admissions collected three months following implementation. Preliminary post-implementation data demonstrates that, on average, OIT is being given at six hours of birth as opposed to 13 hours, which was the average prior to the initiative. At the end of the study, statistics regarding NEC and NI outcomes will be drawn from the Canadian Neonatal Network database and analyzed over the same time periods, before and after the intervention. Centre-specific neonatal morbidity and mortality rates, presented yearly at the national EPIQ-II data sharing conference, will then be correlated to the NEC and NI outcomes at LHSC-VH.

Positive Outcomes

Having an ill or preterm infant in the NICU can be an overwhelming experience for parents. Parents are seemingly grateful to be offered the opportunity to engage in their baby's care, specifically assuming the role of providing vital nutrition and immune support. Mothers experience a great sense of satisfaction and accomplishment when able to express valuable drops of liquid gold. Fathers also enjoy administering OIT to their babies, and this practice is encouraged as it serves to curb feelings of helplessness, common among parents with sick infants. Additionally, mothers are more likely to continue expressing regardless of whether they are postpartum patients or are transferred to other inpatient areas. Consequently, nursing staff outside obstetrical care are increasingly becoming educated and engaged in the Liquid Gold initiative.

Providing standardized education and training for proper technique of hand pumping/expressing moves us closer towards meeting organizational criteria for WHO/UNICEF Baby-Friendly Hospital designation. Moreover, hand expressing is cost-effective, does not require sophisticated equipment and expedites the collection of colostrum soon after birth.

Despite limited financial resources we have achieved a successful campaign. The purchase of the breast simulator was a worthwhile investment for hands-on training. Additional staffing and supply costs from our milk preparation area were mitigated by having mothers prepare and label their own syringes. Software modification to our current breast milk identification system was negotiated at minimal cost, and a "quick feed" option was added for OIT in

order to maintain the safety standard of breast milk provision. Moreover, as part of national collaboration that occurs through EPIQ-II, access to teaching resources from other NICUs across the country was available. This access greatly reduced the cost and workload required to develop staff and parent education materials.

The greatest reward came, however, unexpectedly in the form of enhanced therapeutic relationships with mothers, babies and their families. This bolstered our planning group's sense of team building and encouraged them to expand this collaborative spirit to include staff and stakeholders in other areas of the hospital. For example, the Critical Care Trauma Centre (CCTC) team is now acutely aware of the need to consult with a lactation specialist for critically ill mothers who wish to provide breast milk for their babies.

Challenges and Recommendations

Challenges were inevitable considering the task of implementing practice change across an entire perinatal program. Thoughtful planning, collaboration and comprehensiveness are fundamental to education campaigns of this magnitude, which demand early leadership support and resource allocation. The education component for OIT required a substantial time commitment to address the knowledge and skill development of approximately 350 staff members.

An added challenge was implementing an initiative that not everyone had accepted as evidence-based practice. Although most nurses recognize the importance of breast milk nutrition, many practitioners do not appreciate the significance of providing breast milk to reduce the risk of NEC and other life-threatening infections. This quality initiative met the collective learning needs of staff from OBCU, MBCU and NICU in order that all perinatal caregivers would better understand the role of breast milk in reducing morbidity and mortality in preterm and ill infants. As a result, nurses began to acknowledge the valuable contribution they could make by supporting mothers in providing immune protection for their babies.

An important next step will be to disseminate outcome results in relation to OIT delivery and post-intervention rates of NEC and NI among preterm and VLBW neonates who are exclusively receiving mothers' own milk.

Finally, as members of the EPIQ-II Steering Committee at LHSC, our recommendations for moving forward include a commitment to continued education, ongoing evaluation of staff compliance and close monitoring of patient outcomes.

Conclusion/Next Steps

EPIQ-II continues to address the need for ongoing evidence-based practice. Members of the multidisciplinary NICU team at LHSC wish to contribute to the continuous quality improvement initiatives active in 27 NICUs across Canada. We have successfully implemented the Liquid Gold initiative, which includes the early introduction of colostrum given via OIT to preterm and critically ill neonates who may not otherwise receive breast milk owing to their fragile state. Members of the NICU Quality Care Council at LHSC remain dedicated to supporting families in protecting the health and healing of these precious little miracles. We hope you will join us!

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