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Evaluating the Precision of Clinical Assessments for Feeding Intolerance

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ABSTRACT

Feeding intolerance is a common occurrence in preterm infants, yet there are no precise measures for clinically assessing this potentially serious manifestation. This article reports the results of a study designed to evaluate neonatal intensive care (NICU) nurses' precision in abdominal and emesis assessments, considered the most objective, observable signs of feeding intolerance. Forty-six NICU nurses participated in the study by observing pictures of preterm infant abdomens and pictures of "staged" emesis. There was little agreement among the participants regarding the infant abdomen pictures or the amount of emesis observed in the pictures. There was no relationship between years of NICU experience nurses' assessments. The ability of nurses to assess clinical signs of potentially serious complications in preterm infants is critically important. Standardized education and training as well as precise assessment tools are needed.

Definition and Significance of Feeding Intolerance

Preterm infants are unable to tolerate full enteral feedings immediately after birth. Instead, these newborns are placed on trophic feedings with a gradual increase to full enteral feeding status administered through a nasogastric tube. This process is individualized based on the infant's gestational age, weight, clinical status, and enteral tolerance. The healthcare team in the newborn intensive care unit (NICU) monitors the infant's tolerance to the enteral feedings for any suspicion of feeding intolerance (FI). Clinical manifestations and symptoms of FI include large gastric residuals, abdominal distention, emesis, bloody stools, apnea, bradycardia, hypotension, and temperature instability.[1,2]

The incidence of FI in preterm infants is estimated from 16–29% depending on the definition used.[3,4] Previous studies have defined FI using measurable outcomes (i.e., days to reach full enteral feedings) while other studies have defined the concept using one or more of the clinical manifestations listed above (i.e., number of emesis in a 24-hour period). For the purpose of this article, the operational definition of FI will comprise of the final definition described in a recent concept analysis, "FI in the premature infant is the inability to digest enteral feedings presented as GRV more than 50%, abdominal distention or emesis or both, and the disruption of the patient's feeding plan."[2]

FI is a clinically significant clinical phenomenon because of its known association with necrotizing enterocolitis (NEC), a gastrointestinal emergency that is the primary source of neonatal morbidity and mortality.[5] Although the exact pathogenesis remains unknown, NEC is believed to be associated with an unknown cause of dysregulation within the inflammatory cascade causing damage to the intestinal mucosa.[6]

Precipitating events and risk factors for NEC often are generalized and systemic such as hypoxia and sepsis. FI also has been theoretically associated with a disruption in the gastrointestinal homeostasis through the brain-gut axis and enteric nervous system.[7,8] Stress, which includes the physiologic stress from disease processes, is thought to affect gastrointestinal function because of the complex and intricate processes within the enteric nervous system. A recent study confirmed this hypothesis because of an association found between levels of stress biomarkers and FI in preterm infants suggesting physiologic dysregulation may play a role in FI.[9] Both NEC and FI are multifactorial and likely reflect the multiple body systems involved in the etiologies.

Since the exact etiology of NEC and its link to FI remains unclear, clinicians typically respond to clinical manifestations of FI by changing the infant's feeding care plan. Changes in the feeding plan include decreasing, withholding, or discontinuing enteral feedings which then prolong the use of intravascular access, Total Parental Nutrition (TPN), and enteral fasting and ultimately increases the risk for further complications.[10,11]

Accuracy and Precision of Feeding Intolerance

Clinicians and researchers in the NICU rely on the assessment and critical thinking skills of the bedside nurse to prevent and treat complications of prematurity, specifically FI. Appropriately

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recognizing and measuring visual assessments associated with FI relies on the observational skills and clinical judgment of the bedside nurse. It also requires standardized policies and procedures provided by the institution. The institution is responsible for educating and maintaining competent assessment skills for the nurses as well as staying updated on the current research evidence to provide the safest and best practices for the patients. Carter has provided comprehensive recommendations for universal standard of care assessment guidelines for nurses to use when assessing for FI in preterm infants.[1] These guidelines discuss the nursing assessment techniques, nursing interventions, and anticipated practitioner orders for gastric residuals, abdominal distention, emesis, stool, apnea, bradycardia, and temperature instability. However, psychometric testing for the measurements related to FI has not been explored. Thus, institutions lack substantiated evidence-based practice guidelines for implementation.

Psychometric testing, also called clinimetrics, is used to test the "validity" and "reliability" of measurements used to operationally define a phenomenon.[12] In clinimetrics, validity, which is referred to as accuracy, provides evidence that the measure used (e.g. abdominal distention) is a true reflection of the phenomenon (e.g. FI). Reliability in clinimetrics refers to the measure's precision and provides evidence that the measure (e.g. abdominal distention) is consistent every time (e.g. same interpretation and documentation between nurses). A literature search failed to reveal any reports of the clinimetric testing of physiologic measurements associated with FI. Research on the accuracy and precision of the clinical measurements associated with FI is needed in order to help establish a universal definition of FI and to advance the science and practice for NICU practice guidelines.

The present study was designed to examine the clinimetrics of the final definition stated above from the concept analysis publication.[2] Of the symptoms associated with FI in this definition, abdominal distention and emesis are physiological clinical signs that are considered concrete and objective because they can be physically seen and measured. However, actually measuring and interpreting these clinical signs may be more indeterminate and subjective. Both abdominal distention and emesis have been vaguely defined in previous studies.[2] Specifically, abdominal distention rarely has been defined as a change in abdominal girth using an objective measuring system as suggested by Carter.[1] Instead, abdominal distention has been a subjective observation of the healthcare team. Similarly, emesis most often has been defined as "severe" without specification of volume or color. This definition again must rely on the subjective observation of the healthcare team to define "severe". Therefore, the purpose of this study was to: 1) evaluate the precision of abdominal assessments (flat, round, full, distended) and emesis assessments (small, moderate, large) by NICU nurses; and 2) identify relationships between assessment interpretation and years of clinical experience.

Methods

A prospective, descriptive, correlational design was used. Using photographs of the abdomens of preterm infants and photographs of "staged" emesis on cloth diapers that are typically used as "burp" cloths, NICU nurses were asked to complete a survey regarding their abdominal assessment and emesis amount. Approval from the institutional review board was obtained.

A convenience sample of NICU patients was recruited in order to obtain abdominal photographs. Research personnel identified NICU patients of varying gestational ages and approached a parent for consent to photograph the infant's abdomen. A second convenience sample of nurses working in the level III NICU in a Midwestern US tertiary medical center that served as the study setting was recruited to evaluate the precision of abdominal and emesis assessments for the study. The IRB approved the study as exempt from written consent for the nurses while requiring written consent from the infants' parents. As written consent was not required for the nurses, they were sent a notice of the study's purpose and protocol, an explanation of their human subject rights, and a statement that participation in the study implied informed consent via email. These same documents were displayed in the NICU nurse's lounge and nursing stations prior to the annual, institutional proctored competency exams.

Photographs

After consent and with assistance from the bedside nurse, the lead study investigator took de-identified photographs of the infants' abdominal area during routine caregiving. For the emesis pictures, pre-measured volumes of formula (5 mL, 10 mL, etc.) were dispersed on separate white diaper clothes. A tape measure was then placed on the diaper cloths after dispersion of the varying amounts of formula to be used as a reference point within the photograph.

Procedures to Evaluate Precision

Abdominal and emesis photographs were printed on an 8x11 piece of photo paper and given a specific number. All photographs were compiled in a notebook. At the conclusion of each nurse's annual competency exams, the nurse had the opportunity to participate in the study. A poster about the study, the book of the assessment photographs, a locked ballot box, and a paper copy of the IRB documents (described above) was located in the same area as the competency examinations. Participation in the study was voluntary.

The nurses viewed the book of the de-identified abdominal assessment photographs of NICU patients and the emesis photographs. For each assessment photograph, the nurse was instructed to complete survey questions by selecting responses reflecting their perception of the photographs and consistent with their usual charting preferences. The description options of the survey questions were multiple-choice to avoid penmanship recognition errors following data collection and to be consistent with the institution's current computer documentation format. This anonymous survey also provided a space for the nurse to record his or her years of experience (categorized into 0–5 years, 5–10 years, >10 years). When the nurses completed the survey, they placed their form into the locked ballot box available for that purpose.

The descriptive options for abdominal assessment photographs were *distended*, *full*, *round*, and *flat* which is consistent with the institution's charting. The descriptive options for emesis photographs were *small*, *moderate*, *large*, *x1* (non-specific documentation that the infant had one episode of emesis), *5 mL*, *10 mL*, *15 mL* and *20 mL*. Nurses were able to choose more than one answer for the emesis options to remain consistent with usual charting preferences.

Statistics

Descriptive statistics and ANOVA were performed using SPSS, version 19 (SPSS Inc., Chicago, IL).

Results

The parents of 6 NICU patients consented to the study. These infants were photographed during routine caregiving; 10 abdominal assessment photographs were used. The second convenience sample included 46 (73%) of the setting's NICU nurses who completed the study. Nurses displayed wide variability in their perceptions of the abdominal and emesis assessment photographs. Table 1 shows the results of the nurses' assessments.

Abdominal Distention

Examples of the abdominal assessment photographs are see in Figs 1, 2, and 3. Fig 1 is an abdominal photograph of a preterm infant at