Improving Postoperative Neonatal Nutritional Practices in an Intensive Care Unit Using the PDSA Cycle

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ABSTRACT

Quality Improvement models offer a framework for health care professionals to follow in implementing process improvement changes. Use of these models promotes a systematic approach to problem solving, keeps providers from eliminating important steps, facilitates team work, and provides a clear plan for ongoing communication. This paper describes use of the Plan-Do-Study-Act model to implement a unit-based quality improvement project that focused on improving postoperative nutritional practices for neonates with critical congenital heart disease following complex cardiac surgery. J Pediatr Health Care. (2018) ■■, ■■-■■.

KEY WORDS

Plan-Do-Study-Act (PDSA), quality improvement (QI), nutrition, congenital heart disease, postoperative, feeding protocol

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Quality improvement (QI) models provide a framework for health care professionals to follow in implementing process improvement changes. Using these models in health care provides a systematic approach to problem solving, keeps providers from omitting important process improvement steps, facilitates team work, and creates a clear plan to communicate at any given time. This article illustrates the practical use of the Plan-Do-Study-Act (PDSA) model to guide implementation of a unit-based QI project that focused on improving postoperative nutritional practices for neonates with critical congenital heart disease (CCHD) after complex cardiac surgery.

PLAN-DO-STUDY-ACT

The PDSA model was first described by Walter Shewhart and Edward Deming (Taylor et al., 2014). It is a four-stage cyclic approach to process improvement that includes stages of change that involve planning an intervention to an identified problem, implementing the intervention, studying the outcomes of the intervention, and acting to sustain or improve the intervention. This model has been tested and evaluated in health care settings and is considered reliable and valid (Taylor et al., 2014; Varkey & Resar, 2007).

Plan

The Institute for Healthcare Improvement (2014) states that planning entails defining the problem, assessing the situation, and analyzing the cause. The first step in this project was to define the problem. Worldwide, health care organizations use anthropometric

measurements to assess levels of malnutrition (Joosten & Hulst, 2014). In this situation, a comparison of neonates' birth anthropometric measurements (height, weight, head circumference) with their discharge measurements showed that neonates undergoing heart surgery were not gaining weight or growing during hospitalization. After identifying this problem, the project champion, a pediatric cardiothoracic surgery nurse practitioner, organized a multidisciplinary task force to assess the situation and examine the nutritional practices in the pediatric cardiothoracic intensive care unit (CTICU) from the time of patient breathing without airway and mechanical ventilation support to discharge. The task force consisted of 25 members and included a cardiac surgeon, pediatric intensivists, a neonatologist, a pediatric gastroenterologist, dieticians from the CTICU and neonatal intensive care unit (NICU), representatives from occupational therapy and speech therapy, the CTICU nurse practitioner (project champion), bedside registered nurses, and medical and nursing directors. Using a fishbone diagram, the task force identified barriers to proper nutrition in the CTICU (listed for clarity in the Table). In addition, a Pareto chart, which graphically summarizes and displays the relative importance of the differences between groups of data, was created, and each task force member voted on the factors they believed were contributing to the problem. Practice variation was identified as a primary cause of the problem, and eliminating it became the top priority of this project.

An exhaustive review of the literature undertaken early in this process by the project champion showed that there was no published consensus recommending specific evidence-based postoperative feeding guidelines for use with neonates with CCHD. As a result, the multidisciplinary task force reviewed the only existing published algorithms (Braudis et al., 2009; del Castillo et al., 2010; Slicker et al., 2013). Notably, protein supplementation and criteria for feeding intolerance were not addressed in these algorithms. These two factors can hinder health care providers in providing adequate nutrition in the CTICU. Insufficient protein intake can result in muscle breakdown and decreased muscle mass (Adamkin, 2009); muscle mass is essential for optimal growth to occur. Signs of feeding intolerance can cause health care providers to hold feedings; thus, insufficient caloric and protein requirements are administered, leaving neonates susceptible to malnutrition.

The task force determined that there was not adequate evidence to support use of one single specific algorithm. Therefore, the task force adapted algorithms from each of the studies and created a new algorithm that included objective criteria for feeding intolerance and protein supplementation. The findings from del Castillo et al. (2010) were used to develop contraindications and considerations for initiating enteral feedings. The results of Braudis et al. (2009) were used to determine criteria for continuous versus bolus feedings and timing of assessment for feeding tolerance. Finally, the recommendations of Slicker et al. (2013) were used to determine how to consolidate continuous nasogastric feedings and criteria to evaluate aspiration. Protocol inclusion criteria were also developed, which addressed diagnosis, age, weight, and postoperative respiratory and hemodynamic status, as well as exclusion criteria, such as heterotaxy and hemodynamic instability, as defined by reliance on inotropic agents.

Additionally, the neonatologist on the task force recommended that the use of pasteurized donor human breast milk (PDHM) be included in the protocol. Before this project, PDHM was used only in the NICU for neonates with unrepaired CCHD. Therefore, criteria for the use of PDHM in the postoperative setting was developed in consultation with a high-risk CCHD clinical nurse specialist from another children's hospital. These

TABLE. Barriers to proper nutrition in the CTICU

Nurses	• Feedings are held because of feeding intolerance • Subjective definition of *feeding intolerance* • No formalized nutrition training during CTIUC orientation • Nutrition is not viewed as a top priority in the CTICU environment
Physicians	• Inconsistency in how enteral nutrition is ordered • Lack of knowledge regarding cardiac patient nutritional needs • Inadequate training on how to calculate caloric and protein goals
Nutrition department	• No daily recommendations to help guide physicians in ordering enteral nutrition • Limited dietician involvement in CTICU • Budget restrictions limit dietician assessment to every 4 days
Milk room staff	• Delay in patients receiving higher-calorie formula • Unable to process formula changes within 24 hours of being ordered electronically • Limited number of milk room technicians • Milk room closed, 2:30–4:00 p.m. and 12:30–6:00 a.m.
CTICU	• Decreased maternal–infant bonding • ICU environment • Cardiac anatomy requires close monitoring • Increased risk for feeding intolerance because of decreased perfusion to gut
Patient	• Cardiac anatomy • Increased caloric/protein requirements • Hypermetabolism and hypercatabolism during the postoperative period

Note. *CTICU, pediatric cardiothoracic intensive care unit; ICU, intensive care unit.*