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Nursing and Respiratory Collaboration Prevents BiPAP-Related Pressure Ulcers

Darlene E. Acorda MSN, APRN, CPNP-PC*
Texas Children's Hospital

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In early 2012, an increase in the incidence of BiPAP-related pressure ulcers was noted in the progressive care unit of a large pediatric facility. An interdisciplinary team of nursing and respiratory staff and leadership formed a collaborative to address the gaps in practice, recommend, and implement evidence-based interventions using a quality improvement model. Interventions included piloting new masks, changing the skin barrier from a hydrocolloid dressing to a foam dressing and using a template for better fit, including skin assessments every 4 hours as part of nursing and respiratory therapists' workflow, and implementing a notification process that included Wound Ostomy Continence Nurses, respiratory, and nursing leadership for any redness of skin noted. Weekly rounding and communication by nursing and respiratory leadership ensured consistency and sustainability of practice. Aside from implementation of interventions, the primary focus was to develop a collaborative relationship between nursing and respiratory teams for shared ownership and accountability of patients on BiPAP support. Three months after the implementation of interventions, the occurrence of BiPAP-related pressure ulcers decreased from eleven in the first three quarters to one occurrence in the fourth quarter of fiscal year (FY) 2012. In 2013, the occurrence decreased to five for the entire fiscal year. Since the end of FY 2013, there has only been one occurrence of a BiPAP-related pressure ulcer in the progressive care unit. Close collaboration between respiratory and nursing has been the primary factor in decreasing BiPAP-related pressure ulcers. An important lesson learned is that interdisciplinary collaboration leads to improved patient outcomes.

NONINVASIVE VENTILATION (NIV) is a common first-line therapy for many pediatric respiratory conditions. A frequently used mode of NIV is biphasic positive airway pressure support or BiPAP, which provides two levels of pressure, expiratory positive airway pressure and inspiratory positive airway pressure, via a mask interface. Although BiPAP has been shown to provide positive outcomes without the complications associated with endotracheal intubation, it is not without its own risks. The most common causes for NIV failure is mask discomfort and skin breakdown (Yamaguti et al., 2014). Success of BiPAP therapy is highly dependent on the patient's ability to tolerate the mask interface.

Background

The Progressive Care Unit admits all patients requiring BiPAP initiation and those with complex medical conditions requiring intermittent or continuous BiPAP support. In early 2012, an increase in the number of pressure ulcers related to

* Corresponding author: Darlene E. Acorda, MSN, APRN, CPNP-PC.
E-mail address: deacorda@texaschildrens.org.

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BiPAP masks prompted an investigation. Over a 4 month period, eleven pressure ulcers related to BiPAP with one being a reportable stage three ulcer and two unstageable pressure ulcers were noted. A multidisciplinary team of respiratory therapists, nursing staff, and leadership was formed to develop a plan of action. Skin assessments, documentation, and equipment were targeted as primary opportunities for improvement. The goal of the collaborative was to formulate a quality improvement plan around the care delivery practices of both nursing and respiratory teams for patients undergoing BiPAP therapy.

Literature Review

A review of the published literature revealed a lack of studies on BiPAP therapy and skin breakdown in the pediatric population. Historically, pressure ulcer interventions and guidelines used in pediatrics were based on adult studies (Schindler et al., 2007). Only in the recent years have there been an increased focus on pediatric pressure ulcers. Multi-site studies have reported an incidence of pressure ulcers in critically ill children to be 18% to 27% (Schindler et al., 2007). The National Pressure Ulcer Advisory Panel reports that medical device-related pressure ulcers account for more than 50% of hospital-acquired pressure ulcers in the pediatric population (Baharestani & Ratliff, 2007). Some of the risk factors for developing pressure ulcers found to be unique in children are prolonged intensive care stays (>4 days), age less than 2 years old, and requirement of mechanical or noninvasive ventilation such as BiPAP, CPAP, HFOV, and ECMO (Schindler et al., 2011). In BiPAP-related pressure ulcers, the areas where the mask contacts the face, the nasal bridge and forehead, are the most common places where skin breakdown occurs (Yamaguti et al., 2014).

The success of BiPAP therapy is greatly dependent on the type of mask interface used (Hess, 2006). Although there are multiple masks available, the nasal mask is the most commonly used in pediatrics. These masks are easy to fit, decrease the risk for aspiration, allow for less dead space, and feel less claustrophobic than other interfaces (Hess, 2006). Although most of these masks have either a gel-filled or open cushion design to relieve pressure on the nasal bridge and forehead, they continue to cause redness of the skin. A study aimed at quantifying the side effects of nasal masks used in noninvasive ventilation in pediatric patients found skin injury in 48% (n = 40) of the study patients (Fauroux et al., 2005). In recent years, full facial masks have been used to address the skin issues associated with oronasal and nasal masks, however, these masks have not been studied extensively in pediatrics, and its effects on pressure delivery and overall tolerance in children are unknown.

As a way to mediate the effects of the mask interface on the skin, a skin barrier is frequently recommended in the literature (Hess, 2006; Schindler et al., 2011). However, there is a lack of studies on the different types of skin barriers and a lack of consensus on the best barrier option. DuoDerm™, a hydrocolloid dressing, was the most commonly used skin barrier in our institution but despite consistent use skin breakdown continued to occur. A literature review on the recommended uses for DuoDerm™ revealed that although it was useful for certain types of wounds, as a hydrocolloid, its main purpose is to provide a moist environment and to promote autolytic debridement but not to redistribute pressure (Davies & Rippon, 2010). However, foam dressings, with its sponge-like characteristics, has properties which absorb moisture, promote debridement, and provide a cushioning effect against mechanical forces such as friction and shear (Davies & Rippon, 2010).

Lack of communication regarding skin issues between nursing and respiratory teams was also noted as a contributing factor to the increased occurrence of BiPAP-related pressure ulcers in the unit. In 2008, the Joint Commission's National Patient Safety Goals emphasized the importance of improving effective communication between caregivers after noting that the most commonly cited cause for sentinel events is lack of communication (Despins, 2009). Studies have shown that a collaborative approach to care taking into account the expertise of each discipline and working towards a common goal results in better patient outcomes (Despins, 2009; Grap et al., 2003).

Quality Improvement Process

The Plan–Do–Study–Act (PDSA) model of quality improvement was used to implement interventions. The first PDSA cycle concentrated on identifying the problem and the gaps in both nursing and respiratory practices. It was noted that there were numerous masks available for use in the hospital with no standardized approach to application. There were also inconsistencies in the practice of applying the masks to the patient and the type of dressing used under the mask. The respiratory flowsheet in the electronic medical record did not include skin assessment, and nurses were afraid to remove the masks to assess the skin for fear of dislodgement of fit causing an increased leak and decreased pressure support. This gap resulted in lack of documentation and ownership of skin assessments. With the problem areas identified and the literature reviewed, the collaborative formulated an action plan for both nursing and respiratory teams.

The different types of masks available and the lack of a standard way of choosing the appropriate mask prompted an investigation into more skin-friendly masks available in the market. At the recommendation of a family, the SleepWeaver™ mask (Figure 1) was piloted over a 2 month period with good results. The mask, made of cloth, delivered the necessary amount of pressure, allowed for an appropriate leak, was more comfortable, and therefore was better tolerated by patients. Although the SleepWeaver™ is FDA approved for children as young as 2 years old, the mask often times did not fit smaller patients. The Pixi™ mask (Figure 2), again at the recommendation of a parent, was piloted for patients who did not fit the SleepWeaver™ with equal success. The mask provided pressure support without interfering with the patient's line of