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The Benefits of Using Adult Learner Theory to Develop a Nursing Policy for Maintaining Skin Integrity around the VAD Site on a Pediatric Cardiac Unit

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Abstract

Background: Cardiac disease in children can vary from mild to severe. Children with severe cardiac disease can develop congestive heart failure and may need a heart transplant. The time congestive heart failure and transplant requires a bridge. The bridge between heart failure and heart transplant is managed with a ventricular assist device (VAD) as the bridge. The bridge-to-transplant is a vulnerable time for a child and requires comprehensive nursing care. In particular maintaining the skin integrity at the VAD insertion site is crucial. Implementing an evidence based nursing policy is a key component. The lack of a nursing policy to maintain VAD site skin integrity may jeopardize the child during the bridge-to-transplant phase.

Objective: The aim was to develop and implement a nursing policy to maintain VAD skin integrity on the pediatric cardiology unit by integrating adult learner theory in the nursing process.

Methods: The study design was a descriptive survey of the dressing change practice. There were three stages of the methodology. The first part was creating a policy, which incorporated the nurses' suggestions for maintaining VAD skin integrity and identifying an acceptable process for dressing changes. The second part involved nurses identifying expert nurses as super users of the policy to facilitate the role out of the policy and dressing change process. The third part was a retrospective chart review to assess if the implementation and outcome of the new policy for dressing changes. The chart review identified 47 children with VAD from 2009 to 2014.

Results: From the review of the 47 charts, there was 100% compliance with the dressing change policy. Skin integrity around the VAD insertion site was maintained for the duration of the VAD. Incidentally, there were no VAD driveline related infections. There was no difference in outcomes based on the type of VAD.

Conclusion: A nursing policy, which incorporates adult learner theory, may contribute to better policy implementation and successful practice change to improve outcomes. Policy compliance may help to prevent VAD site infections and maintain skin integrity. Despite the finding from this small retrospective study, further research is needed to verify its findings.

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Introduction

The ventricular assist device (VAD) in pediatrics is the lifeline for a child waiting for a heart transplant. A crucial element of the VAD is maintaining insertion site and driveline integrity [1]. The nurse plays an essential role in managing the VAD dressing [2]. Nursing plays an essential role in preventing hospital-acquired conditions [3]. It is crucial to maintain the integrity of the VAD dressing because of the impact on the child's well-being and readiness for heart transplant [1,2,4,5]. Ensuring the VAD site is clean, dry, and secure requires a well-placed dressing [4]. The dressing needs to support the VAD driveline and protect the insertion site while promoting the child's normal day-to-day activity [2]. A well-placed dressing can potentially maintain skin integrity, protect the VAD driveline, and support the child's activity.

A nursing policy is part of the nursing process which strives to standardize care to ensure each patient will have access to quality care [3]. The VAD dressing policy is no exception. In addition, standardizing the VAD dressing may positively affect outcomes for children. To maximize the impact of the policy nursing engagement is vital.

According to Knowles Adult Learning Theory involving the nurses in the VAD dressing change policy would result in higher engagement of policy implementation [6]. Incorporating nurses' concerns and problems with existing VAD dressing change policy validates their lived experience [6-8]. By validating nurses' concerns regarding an existing policy changes the rollout of a new policy from content-orientation to problem-orientation [9]. Providing education centered around a problem makes the content relevant to clinical practice [6-9]. The nurse can envision how the change may have a positive impact on clinical practice, which supports engagement in clinical practice change [6-9]. Adult learning theory supports engagement of the nurses on the pediatric cardiology floor in policy development and rollout.

Background

Every year in the U.S., about 40,000 babies are born with a heart defect and of those about 4,800 have a critical heart defect [10]. Cardiac disease in children can vary from mild to severe [10,11]. Children with severe cardiac disease can develop congestive heart failure and may need a heart transplant [4,5,10-12]. The time congestive heart failure and transplant requires a bridge. The bridge between heart failure and heart transplant is managed with a ventricular assist device (VAD) as the bridge [4,5,10-12]. The bridge-to-transplant is a vulnerable time for a child and requires comprehensive nursing care. In particular maintaining the skin integrity at the VAD insertion site is crucial [4,13]. Implementing an evidence based nursing policy is a key component in maintaining the integrity of the insertion site. The lack of a nursing policy to maintain VAD site skin may jeopardize the child during the bridge-to-transplant phase. A review of the literature resulted in an in-depth physiological management of the child on a VAD but lacks insight on the best policy for site management [1,2,4,5,10-18]. The need for preventing infections and the negative impact of infections on outcomes is recognized [4,12-14]. Promoting childhood activities and encouraging normalcy during the bridge-to-heart transplant period is another aspect of the child's care that should not be overlooked [11]. After reviewing the literature there is a dearth in site management and policy development of site management.

With the growth of the cardiac program at this pediatric institution, nurses realized the limitations of the current VAD dressings that consisted of gauze and ties. Anecdotally, the nurses reported limitations of the VAD dressings to included frequent changes; break in sterility, friction against the skin, poor securement of the tube, perceived risk for infections and limitations in mobility. Recognizing the limitations of the current dressing the nurses asked for a change in practice. Nurses on the pediatric cardiovascular intensive care unit (CVICU) and the pediatric cardiovascular unit identified the need for a different dressing and supporting policy to ensure standardization of care.

There was an opportunity to improve skin integrity outcomes of the VAD insertion site. There were incidences of erythema, irritation, and skin infections. By forming a committee of nurses to address the concerns of the existing dressing change policy, a new policy was developed. In early 2009, clinicians worked with the VAD manufacturers to develop a dressing policy that would meet the needs of children, families, and nurses. The result was a dressing to maintain site skin integrity and incorporation into a policy after receiving support from the nurses CVICU and pediatric cardiovascular unit.

Aim of the Study

The primary end-point of the study was aimed at understanding whether practice changes reflected the new policy and if utilizing Knowles Adult Learning Theory was beneficial [6]. The secondary end-point was impact on outcomes and sustainability, as measured by infections at the cannula insertion site and documentation.

Methods

Study design

The study design was a descriptive survey of the dressing change practice. Nurses from the both the CVICU and the cardiac unit who identified themselves as wanting to be super users enrolled in training after being involved in the development of the new policy. All nurses from the unit reviewed education regarding the policy, implementation, and use of super users. It was important to review the nursing process to support the relationship between nursing engagement and implementation in policy change.

Ethics and data collection

After receiving Institutional Review Board approval, a retrospective chart review was conducted of children who were identified to have had a VAD device per the device data log. Children's identity was protected and blinded to the study authors. Data collection consisted of chart review that spanned from June 2009 to November 2014. The charts review included VAD site care, dressing documentation, and site infection.

Dressing change policy

The first type of VAD was the Berlin, which had four insertion sites, one for each driveline. The Berlin dressing change was a two-person sterile procedure performed daily on postoperative days 1 to 10; every Monday, Wednesday, and Friday on postoperative days 11 to 21; and weekly after 21 days postoperatively. Once a sterile field is prepared and supplies are gathered, the assist nurse removes the dirty dressing. The primary nurse uses gauze dipped in equal parts chlorhexidine gluconate 4% and sterile water to clean cannulas in a side-to-side and circular motion for at least 30 seconds, three times per cannula. The nurses use one gauze for the top of the cannula, another gauze for underneath the cannula, and a third wrapped around the cannula, cleaning it in a downward motion. The skin is then allowed to air dry, and once dry, a new dressing is placed. That dressing consists of a chevron of inch-wide dampened silver fabric strips (only used after 21 days postoperatively), split gauze around each cannula (2 × 2 for 10 mL pumps and 4 × 4 for larger pumps), and another piece of gauze layered on top. Then an abdominal pad is placed and dressing ties with straps are secured around the dressing. Finally, a stretch bandage is wrapped around the patient to further secure the dressing.

The next type of VAD includes the HeartWare and HeartMate II. This VAD has one driveline and one insertion site. HeartWare and HeartMate II dressing changes are two-person sterile procedures performed every Monday, Wednesday, and Friday. Once a sterile field is prepared and supplies are gathered, the assist nurse removes the dirty dressing. The primary nurse uses chlorhexidine gluconate 2% in 70% isopropyl alcohol in a gentle circular motion to cleanse the driveline insertion site, with a second chlorhexidine gluconate 2% in 70% isopropyl alcohol utilized for underneath the driveline. Two-chlorhexidine gluconate 2% in 70% isopropyl alcohol applicators are sandwiched and the driveline is cleaned starting proximally to distally. The skin is then allowed to air dry, and once dry, a new dressing is placed. That dressing consists of a split 2 × 2 gauze around the drive line, with gauze placed on top. Then a transparent assist device dressing is placed over the site in an occlusive manner, with the percutaneous lead looped for immobilization using a securement device.

Process change

The dressing change process was framed around Knowles Adult Learning Theory. The nurses from the unit were involved in the policy development and education with support from the clinical nurse specialist. Starting with education through written, audiovisual, and return demonstrations in the initial phase and then on a yearly basis. This training was developed to engage the pediatric cardiac nurses to support the transfer of knowledge to practice and retention. Ongoing support during dressing changes provided through 2010 and early 2011 by the extracorporeal membrane oxygenation coordinator, CICU clinical nurse specialist, and certified wound ostomy continence nurse. Real-time support gradually tapered as the nurses reported feeling comfortable with the dressing changes.

Before caring for a patient with a ventricular assist device, cardiac staff nurses attended a 4-hour didactic course regarding the device and dressing changes. A team of "super users" was created from those who received the training. The super users met for two hours monthly with the unit educator and ventricular assist device educator to receive extra training in ventricular assist device management, with a special emphasis on dressing changes. The role of the super users was to serve as a preceptor to new ventricular assist device nurses and to be a resource to their peers.

Nurses caring for the child with a VAD for the first time worked with their super user preceptor for 8 of the 12 hours of a bedside shift, with the super user being available to them for help if needed during the last 4 hours of the shift. The super user also guided them through their first dressing change. The unit educator completed weekly audits of VAD dressing changes to ensure standardization and competency. Competency maintenance was through an annual 4-hour review course consisting of both lecture and simulation drills. To maintain skills throughout the year, nurses had to complete at least 12 hours of bedside care for a patient with a VAD. An online portal available for all staff, with links to ventricular assist device policies and procedures, educational information, and a PowerPoint presentation explained the dressing changes step-by-step.

Results

A total of 47 ventricular assist device cases were identified over the 5-year period, with 30 males and 17 females. The Berlin was used in most cases with greatest number of days on the device (n=24; 108.42 days) **(Table 1)**. Most VAD were placed because of cardiomyopathy (53.2%), followed by congenital defect (23.4%) **(Table 2)**. The mean age of the patients was 7.14 years, and the overall mean of days on ventricular assist device support was 87.51 (4113 days). The time on support varied for boys and girls but girls spent more time on the ventricular assist device in days. **(Table 3)**. There was 100% compliance with the newly implemented policy for dressing changes in the chart review. Secondary findings included no infections—either site infections, bloodstream infections, or driveline infections—were reported in these 47 cases. The retrospective chart review resulted in compliance of policy and no infection when the dressing was done per the guidelines regardless of the ventricular assist device used.

Table 1 Number of days on the device.

Type of Device	Frequency of Devices	Days on Device	Average-Mean
Berlin	24	2602	108.42
Heartmate	9	680	75.56
Thoratec	2	221	110.5
Heart ware	9	483	53.67
Centrifugal	3	127	42.33

Note: *n=47, total Ventricular Assist Device Days 4113.

Table 2 Characteristics of the 47 children during the 5-year review period following ventricular assist device dressing education and protocols.

Variable	Result
Sex [n (%)]	
Male	30 (63.8%)
Female	17(36.2%)
Age, mean (SD)	
Male	8.8 (7.2)
Female	4.1 (6.0)
Ethnicity [n (%)]	
Caucasian	20 (41.7%)
African American	3 (6.3%)
Asian	19 (39.6 %)
Pacific Islander	4 (8.3 %)
Hispanic	3 (2.1%)
Aboriginal	1 (2.1%)
Cardiac diagnosis [n (%)]	
Cardiomyopathy	25 (53.2%)
Failed heart transplant	2 (4.3%)
Congenital defect	11 (23.4%)
Myocarditis	4 (8.5%)
Heart failure	5 (10.6%)
Time on support (days) mean (SD)	
Boys	79.5 (67.5)
Girls	101.7 (58.4)
Berlin device (n = 24)	108.4 (72.3)
HeartMate device (n = 9)	75.6 (36.1)
Thoratec device (n = 2)	110.5 (3.5)
HeartWare device (n = 9)	53.7 (60.7)
Centrifugal device (n = 3)	42.3 (36.5)

Table 3 Ventricular assist device in days.

Mean	Boys (n=30)	Girls (n=17)
Age at time of Placement (years)	8.86	4.15
Ventricular Assist Device days (days)	79.57	101.71

Note: *n=47

Discussion

The chart review demonstrated early adaption of the new policy for VAD dressing changes. Engaging the nurses to create the new policy for the dressing and dressing change process may have yielded in early adaption and sustained practice of the new policy. Early engagement of nurses in change process and policy implementation results in early buy-in to the change [9,15,16]. The identification of super users from the unit fostered policy implementation by supporting the concept problem-based learning [7-9]. Developing and implementing the VAD dressing change policy within the framework of Knowles Adult Learning Theory demonstrated having early buy-in and support by the nurses [6]. The early adaption to the policy was seen in the documentation and nursing engagement in the education sessions. The use of super users further enhanced the change in policy [7]. Nurses are more favorable to learning from nurses on their unit [7-9]. Nurses volunteering to be a super user support leadership, mentorship and promotes professional growth, which all lend to building morale on a unit [7]. The Adult Learning Theory was a good foundation for this policy change.

A zero-infection rate was achieved immediately after change implementation and was sustained throughout the 5-year period. Based on the chart review, it is not clear if the dressing material or the method in which the dressing was changed was responsible for the zero-infection rate. However, it is clear that both the process of dressing changes and the dressing used had positive outcomes. The Institute of Medicine's emphasis on implementing nursing best practices in a supportive, systematic manner to prevent harm was evident in the review of charts [3].

The approach to the dressing change and policy development was multidisciplinary with nurses with different levels of experience and specialty were utilized. Successful implementation of a policy development and implementation benefits from nursing leadership and organizational support [3,8,15,16]. Nursing leadership across the organization supported a process of change which actively engaged nurses. The initial support and ongoing support from nursing leadership may have contributed to the sustainability of the dressing change policy lasting 5 years.

The zero rate of infections is especially significant when compared with studies with similar populations. In a group of children on ventricular assist device as a bridge to heart transplant, Hsu et al., reported a 75% rate of infections that required treatment with intravenous antibiotics [5]. Others have reported infection rates as high as 63% in children [12]. The phenomenon of infections of VAD sites is complex and requires further study in pediatrics [5,12,13].

Limitations

As the case with any research, the study suffers from some limitations to be taken into account when the current findings are to be interpreted. This study was not a randomized prospective design and is subject to the inherent problems of a retrospective study. The study was limited to one institutions pediatric cardiovascular intensive care unit and pediatric cardiovascular floor and therefore is limited in generalizability. There is no measure of the nurse's level of knowledge regarding the dressing change and process before and after the education sessions. The impact on the child's and family's quality of life was not measured for impact, in future studies it would be beneficial to explore the child's perspective on the dressing. Understanding the child's perspective of living with a VAD is equally important [17,19]. However, the study might be used as a springboard against which future studies and policy development.

Conclusion

The sustained best practice changes and good outcomes for the VAD sites seen here is the start of building evidence-based practice. Utilizing of a practice model that promotes collaboration and engages the super user to foster policy change and implementation of a new policy demonstrated to be effective. The sustainability of a policy change with ongoing support from nursing leadership and the super user demonstrated best

practice in maintaining skin integrity of the VAD insertion site. The incidental finding of no infections at the VAD insertion site is noteworthy but requires further studies determine causality. Although more research is needed over time with a variety of cases, the results from this 5-year retrospective chart review are promising in suggesting that VAD site skin integrity can be maintained through a broadly implemented nursing policy.

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