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Effect of Kangaroo Care on Cardiopulmonary

Events in Neonates in the NICU

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Abstract

Introduction: Infants in the NICU often suffer from physiologic stress related to bradycardia, apneic spells, and oxygen desaturations. This review analyzes the effect of KC on the frequency of cardiopulmonary events.

Methods: Databases utilized include PubMed, Google Scholar, and CINAHL. These papers were selected based on their publication in the last ten years, and focus on examining effects of skin-to-skin care on the NICU infant as measured by the infant's physiological stability.

Results: All three studies showed that infants in the treatment groups had a significantly decrease in bradycardic events compared to control group. Two studies found that infants in the treatment group had significantly fewer oxygen desaturations while being held skin-to-skin versus the time they spent in the warmer.

Discussion: The studies used high fidelity of intervention, and two of the three used randomized controlled trials designs. The small sample size of the studies was a weakness and warrants further research.

Conclusion: Nurses should develop policies for increased encouragement for kangaroo care for preterm infants in NICUs.

Introduction

Background

The first few days and weeks of life are often the most precarious in a child's life. As defined by the World Health Organization (2003), skin-to-skin or kangaroo care (KC), is early, continuous, and prolonged skin-to-skin contact between the mother and baby. The practice of KC, was officially developed in the 1970s in response to rising mortality

rates of infants in a NICU in Colombia, where the incubators were unreliable (De Château, 1976). KC has been shown to reduce the risk of death, infection, and decrease NICU length of stay. It has also been shown to increase breastfeeding rates, and improve bonding between parent and infant (Lowdermilk, Perry, Cashion, & Alden, 2012).

According to Harrison and Goodman (2015), NICU admission rates have been increasing in the past ten years. They reported that in 2012 there was a 4.3% admission rate for normal-birth-weight infants, 84.41% admission rate for very low-birth-weight infants, and an admission rate of 7.79% for all infants born in hospitals. In 2013, the US preterm birth rate was 11.39%, the cesarean delivery rate 32.7%, and the twin delivery rate 3.33%; these are complications that often lead to NICU admissions (Martin, Hamilton, & Osterman, 2014). Infants in the NICU often suffer from decreased bonding time with parents, frequent agitation from medical procedures, and physiologic stress related to prematurity or medical problems. Infants in the NICU frequently experience cardiorespiratory events such as bradycardia, apneic spells, and oxygen desaturations. These events can be extremely taxing and harmful to the infant, and can sometimes cause death.

Western medicine has not acknowledged the validity of the practice of KC, and therefore it is not widely promoted in modern hospitals. Many professional organizations such as the March of Dimes, Hand to Hold, and Healthy Children promote KC and endorse its positive effect on preterm infants whose conditions are suboptimal. However, current standard of practice is to keep infants in isolette warmers while in the NICU. While it is not discouraged in the hospital setting, it is not a nursing standard of care to promote KC in parents.

KC has been well documented in its benefits for developing infants. A study by Heidarzadeh, Hosseini, Ershadmanesh, Tabari, & Khazaei (2013) showed that KC increases the rate of exclusive breastfeeding by 50% on hospital discharge. Boundy, et al. (2015) found that KC was associated with 47% lower risk of sepsis. Another study showed that KC decreased hospital readmission rates by 58% (Tessier, et. al, 1998). Isaza, Said, Cabrera, & Rais-Bahrami (2015) found that KC reduced maternal stress levels. Though there is much research on the benefits of KC, there is a gap of knowledge within the hospital setting how KC affects vital sign stability of neonates in the NICU.

Significance to Nursing Practice

This paper will systematically review three randomized controlled trials to analyze the safety of KC and its effect in reducing the frequency of cardiopulmonary events in preterm infants in the NICU versus standard care (SC). With this knowledge, it is critical for nurses to be able to confidently and effectively promote KC in parents. While infants are in the NICU, it is the responsibility of the nurse to monitor physiological vital signs, and create a nursing plan to maintain the stability of vital signs. Nurses' expertise also lends them the ability to take a leadership role and advocate for and pursue the creation of a KC protocol in the hospital. Nurses should be advocates and educators in promoting KC to parents to provide warmth, bonding, and all aforementioned benefits to themselves and their infants.

Methods

This accumulation of research utilized the scholar databases PubMed, Google Scholar, and CINAHL. The key words searched to find specific results were "NICU", "neonatal", "skin-to-skin", "kangaroo care", "events", "vitals", "stabiliz*", "infant",

“cardiorespiratory”, and “cardiopulmonary” in order to find articles about the effects of skin-to-skin care on neonates. The asterisk in the word “stabilize” was intended to include all suffixes of the root “stabiliz-” such as “stabilizing”, “stabilization”, and “stabilized”. Certain filters were also applied to limit articles including “English-only”, age specification to under 1 year (in CINAHL and PubMed), and limiting the results to articles that were published 10 years ago or less. Initially, the filter “published less than 5 years ago” was implemented, but the scant amount of results prompted the broadening to 10 years. Studies were screened to include only those using a randomized controlled trial with the use of skin-to-skin therapy in neonates and measuring various physiological outcomes. In each search engine, five to ten articles were found to match the subject, and the three primary articles selected to be the focus of this paper were most closely related to the subject, and were published in scientifically recognized journals within the last 10 years.

These papers were selected based on their focus on infants in the NICU, examining effects of skin-to-skin care on the infant as measured by the infant’s physiological stability. The articles were also the most focused on measuring results related to changing vital signs and cardiopulmonary events.

Results

Each study examined the effects of KC on infants’ heart rate, respiratory rate, and oxygen saturation. The set length of time of the experiment varied from 6 hours to 7 days. Two studies continuously monitored the infants’ vital signs while the third study performed hourly vital signs only. Though the methods were slightly different throughout the studies, two common themes emerged: heart rate and oxygen saturation. All three

studies showed that infants in the treatment groups had a decrease in bradycardic events compared to control group. Two of the three studies found that infants in the treatment group had fewer oxygen desaturations while being held skin-to-skin versus the time they spent in the warmer.

Decreased Bradycardia

All three studies measured the infants' respiratory rate, oxygen desaturation, and duration and frequency of apneic spells. Sutar et al. (2015) found that the treatment group had fewer bradycardic events per hour while being held versus incubator time ($M_{KC}=0.10\pm0.16$ vs. $M_{control}=0.20\pm0.19$, $p=0.02$). They also reported significantly fewer bradycardic events between the treatment and control groups ($M_{KC}=0.10\pm0.16$ vs. $M_{control}=0.24\pm0.16$, $p=0.002$). Consistent with the other two studies, Heimann et al. (2009) found that heart rate was significantly higher in KC versus supine position ($M_{KC}=154.86\text{bpm}\pm11.55$ vs. $M_{control}=150.25\text{bpm}\pm14.64$, $p=0.001$), indicating fewer bradycardic events.

Mitchell et al. (2013) found no significant difference in bradycardia rates between the treatment and control groups, but reported a significant reduction of bradycardias within the treatment group when being held versus incubator time ($p=0.048$, standard deviations and means not reported).

Desaturation Frequency

The three studies also measured the infants' desaturation frequencies. Sutar, Baraha, & Mummidi (2015) found that the treatment group had significantly fewer desaturation events than the SC group ($M_{KC}=0.010\pm0.02$ vs. $M_{control}=0.044\pm0.05$, $p<0.001$).

While Mitchell, Yates, Williams, & Hall (2013) found no significant difference in oxygen desaturations between KC and SC (standard deviations and means not reported), found that within the KC group, there were fewer desaturations while being held (2 hr/day) versus placed in the incubator (22 hr/day) ($p=0.017$). This is consistent with Sutar et al. (2015) findings of fewer desaturation events per hour within the treatment group when being held versus warmer time ($M_{KC}=0.010\pm0.02$ vs. $M_{control}=0.056\pm0.06$, $p<0.001$).

The third study's findings were inconsistent. Heimann, Vaeßen, Peschgens, Stanzel, Wenzl, & Orlikowsky (2009) found no significant difference in respiratory rate, oxygen saturation average, or duration of apnea between KC, prone, and supine positions.

Discussion

Two of the three studies were randomized controlled trials, which supports strength of study. Randomized controlled trials provide strong and valid evidence and increase the internal validity of results. A weakness of this analysis is that the study by Heimann et al. (2009) is a repeated measure design. This study observed the vital signs of the participants while in supine, KC, then prone positions, utilizing each position in every infant. This created a study design where each subject acts as its own control. Limitations for repeated measure design include order effects, maturation effects, dropout rates, and interruptions. The possible limitation discussed in the article that would have possibly affected the outcome is interruptions. Interruptions such as diaper changes, procedures, or medication administration may have caused disruptions or inconsistencies in vital signs, and were not discussed in detail in the article. Heimann et al. (2009) did account for and control feedings, which may have posed a potential interruption. As stated in the article,

feedings were consistently maintained; each infant was gavage fed every two hours (h 0, 2, 4, 6) before and in between each position.

A robust strength throughout all three studies was their standardized training and procedure. Each of the studies provided specific instructions and training to staff observing and instructing the participants' parents. The study by Heimann et al. (2009) ensured that all participants' were observed by an author of the study to maintain fidelity of intervention. Sutar et al. (2015) and Mitchell et al. (2013) had trained NICU nurses specially instructed on how to observe, report, and supervise the experiment. This also supports the studies' measurement consistency, as the observation and reporting were standardized. This standardized training increases the fidelity of the intervention, thereby increasing the internal validity of the studies.

A weakness of all three studies is their sampling method. They each used convenience sampling; a form of nonprobability sampling that takes a group of participants based on ease and nearness. Each of the studies took participants from the NICU at the hospital where the study took place. Due to the fact that it does not allow for the estimation of sampling errors, nonprobability sampling is a weakness to the study, and can lead to exclusion bias. Though it is cost-effective, convenience sampling can also lead to geographic and demographic bias. This hinders the study's ability to extrapolate conclusions that apply to a generalized population.

Another weakness of Heimann et al. (2009) is its small sample size of 18, which may not be representative of the population of preterm infants in NICUs. Sutar et al. (2015) and Mitchell et al. (2013) had sample sizes of 36 and 38, respectively, which are still small but statistically sound groups.

One limitation with both Sutar et al. (2015) and Mitchell et al. (2013) experiments is the fact that KC cannot be feasibly performed continuously throughout infancy or even throughout the duration of the experiment. Thus, all participants in the intervention groups of these two studies had warmer time as well as KC, making it difficult to determine a true difference between the two.

Though the sampling method was not ideal, the results of these experiments could be generalized to all communities because of the lack of cultural influence and physical difference within the population of interest. Though premature infants in NICUs have a range of ailments, their reactions to KC would be fairly consistent due to their lack of lifetime outside influence. The external generalization of these studies is therefore relatively valid. The conclusions of this analysis can be generalized for all other preterm neonates under 34 weeks gestation at birth, including low birth weight and very low birth weight. This conclusion cannot be generalized to neonates with additional risk factors for cardiorespiratory instability, ventilation, congenital or genetic abnormality, or maternal opiate use prior to delivery, as those qualities were specified exclusion criteria for the three studies.

Implications

The investigation of the studies by Mitchell et al. (2013), Sutar et al. (2015), and Heimann et al. (2009) indicates that kangaroo care is safe to utilize in preterm infants in the Neonatal ICU. The results of the studies suggest that KC may be efficacious in reducing the frequency of cardiopulmonary vital sign events such as bradycardia or oxygen desaturation.

KC is currently promoted in the first few minutes after birth and then allowed in postpartum units in most western hospitals, but it is not protocol to actively promote and encourage skin-to-skin. The results of this study call for the development of hospital nursing care policies to continue to promote KC in mothers postpartum and those with infants in the NICU. With its safety, benefits, and cost-free nature, nurses should implement KC policies to increase the utilization of KC. By advocating and pursuing policies that require increased encouragement of KC for preterm infants in the NICU, nurses will be putting this evidence-based research into practice. The knowledge that KC is effective and beneficial for preterm infants, and not only does not harm the infant, but reduces the incidence of cardiorespiratory events, is critical for nurses to understand because they must be confident in teaching and encouraging KC in parents. Nurses working in NICUs can speak to the parents of infants on a daily basis, which could potentially make a big impact in the lives of both infant and parent. Also, fewer cardiopulmonary events would lead to an infant's earlier discharge from the NICU. Sources site costs of NICU stays to be anywhere from \$900 to over \$3,000 per day, depending on the status of the infant (Kornhauser & Schneiderman, 2010). Decreased length of stay in the NICU would save insurance companies and new parents significant amounts of money, and KC could help to decrease that length of stay.

In general, the studies showed that infants had fewer bradycardic episodes and fewer oxygen desaturations when being held skin-to-skin versus being in the isolette, and the internal validity of each study is scientifically sound. However, the slight inconsistencies of results and small sample sizes warrant further research in determining whether KC of preterm infants can reduce the frequency of vital signs events. Future

studies should include larger sample sizes and maintain the fidelity of intervention as these studies did. A barrier to future research may be presented with the issue of sample sizes. It is difficult to investigate such a sensitive population as newborns, and consenting parents can be hard to come by.

Conclusion

KC has been shown to provide significant physiological benefits to preterm infants in higher-level NICUs. The analysis of three studies has revealed that infants generally have fewer cardiopulmonary events when being held in KC than when placed in the isolette. Nurses should develop policies to promote kangaroo care for preterm infants in NICUs. Future research is warranted to further support efficacy of KC.

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