Kangaroo care and the ventilated neonate

Whilst there is much evidence highlighting the benefits of kangaroo care for healthy preterm infants, its application in the care of mechanically ventilated neonates remains elusive. This paper reviews the literature underpinning this practice, examining the application and limitation of skin-to-skin contact amongst intubated low birthweight or very premature infants requiring mechanical ventilation and providing recommendations for practice.

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Keywords

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Key points

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1. Kangaroo care with ventilated infants offers benefits in promoting breastfeeding and parental satisfaction.
2. Studies indicate that kangaroo care may enhance the physiological status of ventilated preterm infants, the research addressing this is scant and further studies must be completed.
3. Protocol and guidelines must be utilised in order to ensure safe and consistent practice.
4. There is uncertainty surrounding which ventilated infants are suitable candidates for KC and there is a tangible need for increased research in this area.

First presented in Bogota, Columbia as an alternative to incubator care when such equipment was scarce, kangaroo care (KC) was initially defined as early, prolonged and continuous skin-to-skin contact between mother and newborn, low birthweight infant (LBW infant), until the 40th week of post-natal gestational age[1]. Since its conception definitions of KC have varied and in Great Britain it is now understood to be a form of parental caregiving where the newborn LBW infant is intermittently nursed skin-to-skin in a vertical position between the mother's breasts or against the father's chest for a non-specific period of time[2]. A compelling body of literature supports the practice of KC in all stable infants over the age of 28 weeks' gestation, irrespective of financial setting, due to benefits in maintaining physiological stability, increasing immunity, optimising breastfeeding and facilitating parent-infant bonding[3,4]. The World Health Organisation[4] stipulated that the benefits of KC offer more than an alternative to incubator care, stating that it offers an effective way to meet baby's needs for warmth, breastfeeding, protection from infection, stimulation, safety and love across all healthcare settings.

Although there is much research highlighting the benefits of KC with healthy LBW and very premature infants[5], its effectiveness and application in the care of preterm infants requiring respiratory support by means of mechanical ventilation, remains elusive and a source of much debate amongst healthcare professionals. This paper will examine the application and limitation of KC amongst intubated LBW or very premature infants requiring mechanical ventilation on neonatal intensive care units (NICUs) in Great Britain and provide recommendations for practice.

Physiological stability

A literature search revealed limited publications detailing how KC with ventilated infant affects physiological observations and stability. The use of KC amongst ventilated infants was first presented as a case study demonstrating that two ventilated infants responded well to KC, showing signs of increased quiet sleep and decreased oxygen consumption[6]. Whilst the main focus of this article was on preparation of parents and staff for KC and the extremely small sample group did not permit extrapolation of results, this case study highlighted that KC may have benefits amongst ventilated infants.

Following this a study by Gale, Frank & Lund[7], involving 25 ventilated infants, indicated that during KC, temperature, pulse, oxygenation and respiratory rate remained within normal parameters for infants of 30-33 weeks' gestational age or weighing between 1.2-3kg. However, infants weighing less then 1.2kg or younger than 30 weeks' gestational age showed signs of restlessness, tachycardia and decreased oxygenation during prolonged periods of KC. As only 25 infants were recruited in this quantitative study the findings may not be transferable to other infants. Furthermore, due to the quality of the methodology other variables may have been interacting in the physiological parameters observed, such as medical status or positioning of hold. However, whilst not providing any answers, this study indicated that KC may be safely practised with some intubated neonates and therefore acted as a catalyst for further studies.

More recent research by Ludington, Ferreira and Swinth[8] involving 12 ventilated very premature infants weighing less than 1kg indicated that physiological observations remained stable during KC

and oxygen requirement decreased. Whilst these perceived benefits of KC with small infants apparently contradict findings by Gale et al[7], advances in healthcare technology in the six years separating the studies may account for discrepancies in the results. Again, this study had an insufficient sample group for the methodology used; however the rigorous methodology could indicate benefits of KC with LBW infants in other centres.

On the other hand, results from Smith's[9] quantitative study involving 14 intubated LBW infants were contradictory to Ludington et al's[8] results. Smith found that infants experienced increased oxygen requirement, and suffered an overall reduction in body temperature. However, in this study infants were on average 34 days post-birth, still requiring ventilation and all had been diagnosed with chronic lung disease. Therefore, due to the decreased physiological stability related to infants with chronic lung disease, these findings may not be applicable to infants of younger gestational age who have not yet acquired this condition, as demonstrated in other studies. Moreover, the variation in results between studies may be due to other interacting factors such as discrepancies in technologies used to measure physiological stability, differences in room temperature, positioning of KC holds or the nurses' ability to transfer infants competently.

Transfer technique

A major factor affecting physiological stability during KC in ventilated infants is transfer technique: Ludington-Hoe et al[10] indicated that this is the greatest contributing factor to heat loss and increased stress, resulting in tachycardia or episodes of apnoea. Additionally, the transfer into KC involves positioning and lifting similar to that used during weighing or radiographic procedures, which have been associated with oxygen desaturation[11,12]. In their quantitative study involving 15 intubated LBW infants Neu et al[11] noted that although the infants experienced some physiological or behavioural distress during transfer, observations quickly returned to baseline levels during and after skin-to-skin care regardless of the transfer method employed. Whilst there is some degree of physiological disruption associated with transfer into KC it has been indicated that during skin-to-skin contact infants can experience less variation in oxygen saturation and heart rate than during pre-KC period, plus improved muscle tone and ability to employ self-regulatory manoeuvres[11] (**FIGURE 1**). These positive outcomes affirm the decision to undertake KC in spite of initial stress caused by transfer.

FIGURE 1 Kangaroo care may enhance the physiological status of ventilated infants. Photo courtesy of Marc Hardenberg.

Ludington-Hoe et al[13] proposed that in order to reduce impact of transfer into KC on physiological status two or three nurses should assist in moving the infant from incubator to mother, in order to ensure that the process is swift, thus reducing heat loss and distress. Moreover, involving several nurses minimises the risk of extubation or of any other monitoring leads and intravenous lines becoming dislodged and decreases the amount of time that the ventilation system is disconnected[13].

Following consideration of the literature detailed above it would appear that KC can be safely carried out with at least some ventilated infants provided a suitable transfer technique is engaged[14]. However, it must be noted that no detailed studies regarding physiological stability have been undertaken in Britain; rather the majority were carried out in the USA. Whilst the differences in healthcare systems may negate some findings, on the whole it could be stated that neonatal care is similar in both countries. Therefore, it would seem that given the reported benefits of KC in some ventilated infants this practice has potential benefits for similar infants in Britain.

Breastfeeding

Whilst considering the positive and negative outcome of KC its impact on breastfeeding must be taken into account. There is compelling evidence that due to superior nutritional qualities and immunologic benefits, breastmilk is the optimal food for all infants, regardless of gestational age. Moreover, specific benefits of breastfeeding preterm infants include decreased rates of specific neonatal morbidities such as infection, improvement in cognitive-developmental outcome, and increased maternal satisfaction[15]. However, Jaeger et al[16] demonstrated that whilst a mother may appreciate the benefits of breastmilk, factors such as separation from her infant, stress caused by admission to NICU and fear of expressing milk, can affect her decision to breastfeed following premature delivery. Also, it has been indicated that mothers of infants admitted to NICU, particularly those whose infants are ventilated and require feeds via gastric tube, often find it difficult to establish breastmilk expression and continue producing sufficient milk[17]. Jones and Spencer[18] detail the difficulties faced in establishing preterm breastfeeding and

outline the positive impact of KC in promoting confidence and stimulating milk supply.

Research has shown that, due to stimulation of this endocrine pathway, mothers of preterm infants participating in KC produce larger volumes of breast milk and lactate for longer periods than mothers who do not undertake this care[19, 20]. Whilst these studies were undertaken on stable, non-intubated premature infants the hormone production stimulation associated with KC is relevant to mothers of ventilated infants. Moreover, KC has been shown to reduce the harmful anxiety and stress emotions experienced by mothers in the NICU, therefore promoting the occurrence of successful breastfeeding with ventilated infants.

Parental consideration

In addition to optimising production of milk, the reduction of stress and anxiety associated with KC could serve to improve a mother's perception of her infant's admission to NICU and subsequent ventilation[20]. Moreover, it has been indicated that fathers are also affected by feelings of inadequacy, anxiety and frustration associated with NICU admissions[22-24]. Furman and Kennel[17] postulated that KC facilitated feelings of closeness and helped parents to counteract complex emotions experienced in the NICU whilst forming a bond with their newborn. Additionally, Neu[24] reiterated that the positive emotions experienced during skin-to-skin contact decrease negative emotions experienced by parents in this intensive environment.

Case reports exist documenting the efficacy of KC in ameliorating complications associated with maternal eclampsia[25] and postnatal depression[26]. Although benefits have also been reported through the more traditional approach of parents cuddling their child via blanket holding, two studies have reported increased satisfaction following the practice of KC[21, 27]. As nurses have an obligation to address the health and wellbeing needs of both infant and parents[28], thus fulfilling the concept of family centred care, information should be given to parents regarding the reported parental benefits of KC versus other methods of holding.

It must be highlighted that the majority of parents involved in studies reporting parental satisfaction of KC did not encounter problems during their contact. However, there are numerous risks associated with KC of ventilated infants, including dislodgement of venous or arterial lines and extubation. If accidental extubation or access dislodgement were to occur during KC, this would undoubtedly increase parental stress and anxiety, and may lead to feelings of guilt and fear, thus negating the documented positive parental outcome. Furthermore, this risk has implications towards physiological stability and the safe practice of KC amongst intubated infants. Again, it should be noted that most research reporting parental satisfaction of KC comes from hospitals outside the UK. Due to cultural opinions regarding expression of emotion and views on participation in the practice of skin-to-skin care, not all findings may be directly transferable to British parents.

Evaluation and implications for nursing practice

The documented benefits to breastfeeding and parental satisfaction, and the research indicating the promotion of physiological stability, indicate that KC is appropriate for mechanically ventilated infants. However, the evidence available is scant, particularly in relation to which types of mechanical ventilation are compatible with this technique. Additionally, there is a lack of evidence addressing the limit of gestation and size of infant conducive with this practice. It would seem that more in-depth multicentre trials of KC with ventilated infants, particularly in Britain, are needed in order to ensure that the benefits of KC are generally applicable and establish which infants would benefit from the practice. Ideally further research should be in the form of randomised control trials, with multicentre recruitment of participants in order to increase the sample number and maximise generalisability of results.

- Fear of arterial or venous line dislodgement
- Fear of accidental extubation
- Safety issues for very low birthweight infants
- Inconsistency in practice of KC
- Nurses' feelings that KC added to their work load
- Nursing reluctance
- Medical staff reluctance
- Difficulty administering care during KC
- Staff concerns for parental privacy
- Lack of experience with KC
- Insufficient time for family care during KC
- Belief that technology is better than KC

TABLE 1 Barriers to kangaroo care[27].

A recent American national survey of KC practice revealed that nurses are still reluctant to instigate this care, particularly with infants requiring mechanical ventilation[27]. Factors identified as barriers which deter nurses from undertaking this care, particularly with ventilated LBW babies, are displayed in **TABLE 1**.

The two main concerns expressed were intrinsically linked to the safety of the infant; namely security of intravenous and arterial lines, and a fear of accidental extubation[27]. Engler et al[27] suggest that a lack of uniform guidelines for practice and inconsistency in the way KC is carried out may contribute to these barriers. It has been shown that policies and protocols guide clinical activities and promote consistent quality care whilst providing nurses with legitimacy of their knowledge[29]. Therefore, in order to combat fears regarding the safe practice of KC comprehensive evidence-based policy and protocol guidelines, such as that shown in **FIGURE 2**, should be developed and applied within individual NICUs. The need for protocol to ensure safe and consistent practice is strongly recommended by the World Health Organization[4] who state that every health facility that implements KC should develop a written policy and guideline, incorporating clear criteria for monitoring and evaluation. Moreover, Engler et al[27] highlighted that practice guidelines should emphasise that the decision to implement KC needs to be made on an individual basis, with careful evaluation of the physiological status and holistic care needs of the infant in question[28].

It could be argued that whilst an evidence-based protocol may require the use of two or three nurses for transfer into KC, such ratios are not logistically achievable in practice. However, by utilising an interdisciplinary approach involving all trained staff on the unit, such as doctors and physiotherapists, this ratio could be feasibly attained. Additional constraints that may impact the extent to which holistic care can be implemented following a rigid protocol, include daily unit activities, such as ward round, and

Safe protocol for kanagaroo care with mechanically ventilated infants (KC-Vent)

Kangaroo care is skin-to-skin contact between a preterm infant and a parent, usually mother, chest-to-chest in an upright prone position. The infant is clad in a diaper and has a receiving blanket covering the infant's back. The optimal chair for experiencing kangaroo care is a recliner. Mechanically ventilated infants are intubated or receiving nasal CPAP or oropharyngeal CPAP via a ventilator. The physician will be contacted for approval to kangaroo the infant and confirmation of infant's haemodynamic stability.

Prior to transfer

1. Record infant's baseline ventilator parameters (SIMV/IMV, PIP, PEEP, FiO_2) and haemodynamic (HR, RR, SaO_2) and thermal values (axillary temperature). These measures should be carefully monitored during KC-Vent to ascertain the infant's tolerance of this intervention.
2. With support of a second person, place the infant in supine position. Note any significant changes in the infant or mechanical ventilator requirements.
3. Auscultate the infant's chest for quality of breath sounds, suction the endotracheal tube, and change the infant's diaper as necessary.
4. Suction infant if necessary and drain the vent circuit of condensation. The water condensed in the ventilator tubing will be drained to decrease resistance and maintain flow (Bhutani & Abbasi, 1992).
5. Assess infant's response to the above actions. Wait up to 15 minutes to allow for physiological adaptation to the above ministrations. Adaptation is defined as all physiological parameters returning to baseline and staying there for three minutes. *If adaptation has not occurred in 15 minutes, the infant is probably not stable enough to receive KC-Vent on that day.*
6. Place a receiving blanket, folded in fourths, underneath the infant (or in the bed but easily accessible to the mother) so mother picks up her infant by placing her hands underneath the blanket and moving infant and blanket simultaneously.
7. Position and prepare the chair to be used.

Transfer from incubator to KC-Vent

1. Have two or three staff members assist the mother in the transfer of the infant.
2. Have mother stand at the side of the incubator/warmer while one staff member gathers all the infant's lines on one side of the infant.
3. A second staff member is responsible for transferring and securing the ventilator tubing. (A third staff member may be needed to assist the mother.)
4. Disconnect the ventilator tubing from the ETT and have mother lift her infant and place prone on her chest in one movement.
5. Reconnect the ventilator tubing and have mother or staff member quickly secure the receiving blanket across the infant's back (if not already placed when mother picks up her infant as instructed in step 6 above).
6. Disconnect the ventilator tubing and move mother backwards to recliner/chair, assisting her in sitting once she feels the recliner against her calf. Reconnect ventilator tubing to ETT.
7. Raise the footrest and reposition the infant, as needed, and make sure the infant is tucked in a slightly flexed or comfortable position underneath the blanket. If infant is in fully flexed position, monitor for respiratory compromise and reflux.
8. Drape the ETT circuit securely over the mother's shoulder (be sure adequate circuit tubing length has been provided).
9. Change the setting on the incubator/warmer to air control and set it at 33.0°C for duration of KC-Vent.
10. Monitor the infant's condition every 10 minutes during KC-Vent. Allow KC-Vent for a *minimum* of one full hour if infant's condition remains stable.

Transfer from KC-Vent back to the incubator

1. Have one staff member assist the mother in moving to the front edge of the chair, a second staff member handle the lines, and a third staff member disconnect the ventilator tubing.
2. Assist the mother to a standing position, reconnect the ventilator tubing, and give the infant several ventilator breaths.
3. Disconnect the ventilator tubing and replace the infant in the incubator/warming table in one movement.
4. Reconnect the ventilator tubing and make sure all ventilator tubing is stabilised and all lines are placed securely within the incubator/warming table.
5. Document infant's participation in and tolerance of KC-Vent.

Bhutani, V., Abbasi, S. Evaluation of pulmonary function in the neonate. In: Polin & Fox (Eds.), Fetal and Neonatal Physiology 1992; 2: 853-71. Philadelphia: W B Saunders.

FIGURE 2 Proposed protocol reproduced with permission from Ludington-Hoe, et al. Safe criteria and procedure for kangaroo care with intubated preterm infants. *JOGNN* 2003; 32(5): 579-86.

also drug administration time, owing to the impact this has on the physiological status of the infant.

In view of current barriers to the practice of KC it is apparent that, to overcome such impediments and increase initiation of this practice, neonatal nurses need to receive comprehensive education highlighting up-to-date research evidence[27]. Alongside the promotion of the development of policy and protocols, this education would ensure standardisation of information given to parents, avoiding the confusion highlighted by Neu[24].

Conclusion

An evaluation of the literature detailing the practice of KC amongst ventilated infants indicates that it is possible with some ventilated infants and may even benefit their physiological status and nutritional intake, whilst enhancing the parent care experience. However the question still remains as to which ventilated infants are suitable candidates for KC and there is a tangible need for increased research in this area. The value of nursing protocols and

continued learning has been emphasised in order to ensure that this procedure is carried out safely and with continuity.

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BOOK REVIEW

Double trouble

ISBN: 1 85775 669 X

'Paternity'

ISBN: 1 85775 652 5

Author: Hazel E. McHaffie
Published: 2005
Price: £11.99 each
Publisher: Radcliffe Publishing, Oxford
Living Literature Series

These two books form part of the Living Literature Series published by Radcliffe Publishing. The author Hazel McHaffie is well known to neonatal and paediatric staff for her inspirational work as a Research Fellow in medical ethics at Edinburgh University lecturing widely both in the UK and overseas. Her professional life started in nursing and midwifery and she is therefore particularly well qualified to write novels of medical interest. Hazel has woven and moulded her extensive knowledge of ethics, moral dilemmas and clinical concerns with great skill into real life, everyday, stories of drama and of tragedy. *Paternity* and *Double Trouble* tackle the topic of male and female infertility revealing the potential for pain, distorted relationships and far reaching consequences both medical and moral.

In today's healthcare systems there is an ever growing technology, used in a variety of ways for treatment and in providing care, and also perhaps in more mundane areas of the healthcare services e.g. the provision of electronic patient records. All raise ethical problems for the people receiving care and of course for the staff providing the service for patients in whatever speciality. These issues are often complex and daunting for those involved. These two novels by Hazel McHaffie bring some of these issues into the wider arena while not trivialising or underestimating the challenges faced by today's society. But by using familiar situations and a language that is refreshingly clear, she takes the reader on a reflective journey to question and even to challenge preconceived medical ideas.

I agree with the series editor Brian Hurwitz that these books 'are accessible and compelling and will be enjoyed by general readers as much as by philosophers and health professionals.' I would however go further and suggest that these stories should be used by lecturers teaching nurses, midwives, doctors and social workers as a text for debate and discussion in the healthcare arena.

Barbara F Weller
Nursing Editor