The effect of kangaroo care on pain in premature infants during invasive procedures

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The aim of this study was to evaluate the effect of kangaroo care (KC), implemented by mothers, on pain in preterm infants before, during and after an invasive procedure.

A total of 50 premature infants (25 in KC group, 25 in control group) were included in this comparative, randomized, controlled study. Gestational and postnatal ages of the infants were between 26-36 weeks and 0-28 days, respectively. Infants with congenital abnormalities or sepsis and those who needed mechanical ventilation or surgical intervention were not included in the study. None of the infants received narcotic analgesics. Behavioral and physiologic responses to pain were recorded and Premature Infant Pain Profile (PIPP) was used to evaluate the severity of pain. Collected data was evaluated using SPSS for Windows 11.5 program.

Premature Infant Pain Profile scores were significantly lower at each measurement during or soon after the invasive procedure in infants in the KC group compared to controls.

In conclusion, KC starting 30 minutes before and continuing 10 minutes after an invasive procedure was found to be effective in decreasing pain during and after the invasive procedure in premature infants.

Key words: kangaroo care, newborn, pain, premature infant pain profile, preterm.

Throughout time, newborn infants have been subjected to many medical interventions, including surgical procedures, without receiving appropriate pain medication. In particular, infants being treated and cared for in a Newborn Intensive Care Unit (NICU) cannot escape from having painful procedures applied to them[1]. Early exposure to pain and stress is now known to cause immediate and long- lasting changes in the structure and function of a preterm infant's brain[2]. Exposure to pain and stress in early life is associated with an increased risk of intraventricular hemorrhage, increased oxygen consumption and hypertension. Increased stress hormones and impaired growth and tissue repair are neurotoxic to the hippocampus, and have adverse effects on cognition and memory[3]. These problems have negative effects on the clinical course of an illness, on an infant's adaptation to extrauterine life, on brain development, and on family-infant interaction, and can cause a delay in the infant's growth and development[3-9]. Therefore, pain must be treated properly in newborns to avoid the side effects mentioned above. There are many pharmacologic and nonpharmacologic methods in use today for effective treatment of pain. However, the interest in nonpharmacologic methods is steadily increasing. These methods include positioning, giving oral sucrose or mother's milk, giving a pacifier, breastfeeding, decreasing environmental stimulation, rocking, touching, music, massage, being held by the mother, and kangaroo care (KC)[10-12].

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Stimulating visual, auditory, touch and taste senses is used to activate the gate control mechanism to prevent nociceptive transmission[10]. These procedures play a key role in the pain management of newborns[13]. Various studies have been conducted about the use of these methods alone or together[14-20]. In professional nursing care, it is necessary to decrease the infant's pain as well as the mother's stress.

In this context, by providing a feeling of security for the infant and mother with their interaction can be an effective method of pain management. In a previous study, 80% of mothers stated that they wanted to be with their child during painful procedures[21]. When these reasons are taken into consideration, KC may be considered an effective pain- and stress-relieving method. Only a few studies have evaluated the effect of KC on pain in newborn infants[3,22-24]. In these studies, the effect of KC on pain response was evaluated in infants with gestational age over 30 weeks. The effect of KC on pain among infants with a gestational age of ≤29 weeks is not well established. In the present study, we aimed to evaluate the effect of KC, implemented by mothers, on pain in premature infants before, during and after an invasive procedure.

Material and Methods

A total of 150 infants who met the research criteria and were admitted for treatment and care to the NICU at Mersin University Research and Training Hospital between February and December 2006 were included in this comparative, randomized, controlled study. Gestational and postnatal ages of the infants were between 26-36 weeks and 0-28 days, respectively. Infants with congenital abnormalities or sepsis and those who needed mechanical ventilation or surgical intervention were not included in the study. None of the infants received narcotic analgesics. A total of 100 infants dropped out of the study (91 discharged within 5 days of admission, mothers of 6 infants could not come to the unit regularly, and 3 mothers did not agree to implement KC). As a result, 50 infants comprised the sample, with 25 allocated to the KC group and the other 25 to the control group. The infants were chosen for the groups using a random method by drawing out of a thick, non-transparent envelope.

Premature Infant Pain Profile (PIPP) developed by Stevens et al.[25] was used to evaluate the severity of pain. A pilot test of the data collection tools was conducted with three KC and three control infants who were not included in the research sample. During the pilot test, the clarity of the items on the questionnaire was evaluated and they were then used without change in the study.

Procedure: The local ethics committee at Mersin University Research and Training Hospital approved the study. The infants in the KC group were given KC by their mothers for a 45-minute, uninterrupted period of time every day for five days. It was suggested that the mothers should take a bath before coming to the NICU every day. Before KC, the mothers washed their hands appropriately. During KC, the infants only wore a diaper and cap. The mothers put on a gown leaving the chest area open and the infant was placed between the mother's breasts with head upright to provide the greatest surface area for skin contact[26]. To prevent heat loss, infants were covered with a blanket. The infants in the control group received standard NICU care but not KC.

On the fifth day of the procedure, a vein or heel blood sample was taken from the infants in both groups for routine laboratory investigation. The blood samples were taken at the 30th minute of KC from the infants in KC group and from the infants in control group when they were quiet in their incubator or crib. The infants in the KC group were kept in their KC position for 10 minutes after the blood sample was taken.

Infants' behavioral responses to pain was recorded using a video camera (model: DCR-HC17E, Sony) and physiologic variables, such as heart rate and oxygen saturation, were monitored and recorded (Petaş-KMA-800) for one minute before the invasive procedure, three minutes during the procedure and the first two minutes after the procedure. The video recordings and monitor records of the infants in both groups were analyzed by three experts (neonatology nurse, neonatologist and anesthesiologist) who were totally blind to the study.

The mean of the scores given by the three experts were calculated by the researchers. Data were evaluated using the computer program SPSS 11.5. Appropriate descriptive statistics

were used; chi- square was used for independent variables and Mann-Whitney U, Kruskal Wallis and Pearson correlation tests were used for non-parametric data. In the comparisons, a 95% confidence interval and a statistical level of significance of 0.05 were used.

Results

In the KC and control groups, 54% of the infants were male and 46% were female. Of the total group, 12% had gestational age between 26-29 weeks; 26% 30-32 weeks; and 26% 33-35 weeks. Characteristics of the babies and hospital stay were similar in both groups (Table I).

As shown in Figure 1, the PIPP score for the KC and the control group infants was 4.0 (p=0.928) before the painful procedure. PIPP scores at the 1st, 2nd and 3rd minutes of the painful procedure were 7.0, 4 and 4 in infants in the KC group and 15.0, 15.5 and 15.0 in infants in the control group, respectively. PIPP scores were significantly lower at each measurement in infants in the KC group (p<0.001, p=0.001, p=0.047, respectively). PIPP scores at the 1st and 2nd minute after the painful procedure were 4 and 4 in infants in KC and 12.5 and 7 in infants in the control group, respectively. PIPP scores soon after the invasive procedure were significantly lower in infants in the KC group compared to the control group (p<0.001, p=0.023, respectively) (Fig. 1).

Method of delivery, gender, gestational age, birth weight, receipt of oxygen support prior to the procedure, or PIPP scores before or after the invasive procedure were similar (p>0.05) in both groups.

Obtaining a heel blood sample from infants took 1.1±0.9 minutes, and obtaining a blood sample from a vein took 2.5±0.5 minutes. Obtaining the blood sample from the heel or from a vein did not affect the infants' PIPP scores during or after the invasive procedures (p=0.919, p=0.437, respectively).

Table I. Characteristics of the Babies and Hospital Stay

	KC group (n: 25)	Control group (n: 25)	Total (n: 50)	p
Variations	Mean ± SD	Mean ± SD	Mean ± SD	
Birth weight (g)	1576.6 ± 491.2	1761.5 ± 560.5	1669.0 ± 529.9	0.133
Gestational age (weeks)	31.3 ± 1.9	31.9 ± 1.2	31.6 ± 2.0	0.220
Apgar score (1 min)	6.8 ± 1.7	6.8 ± 1.6	6.8 ± 1.6	0.905
Apgar score (5 min)	8.8 ± 1.1	8.2 ± 1.1	8.5 ± 1.1	0.124
Hospital stay (day)	21.4 ± 13.4	16.1 ± 13.4	18.8 ± 13.5	0.107
Postnatal age (day)	4.9 ± 4.3	4.6 ± 4.5	4.7 ± 4.4	0.970

KC: Kangaroo care. SD: Standard deviation.

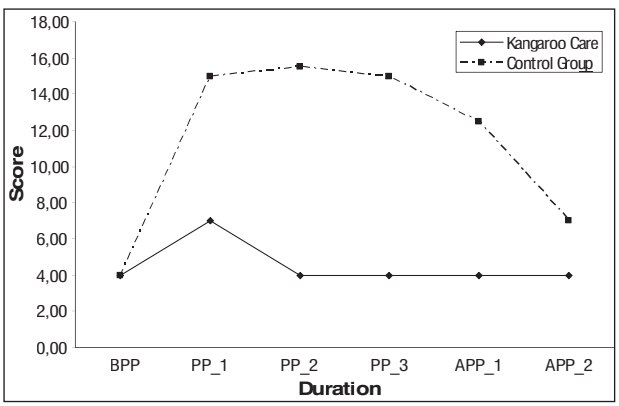

Fig. 1. Distribution of PIPP scores according to time in kangaroo care and control group infants.
BPP: Before painful procedure (p>0.05).
PP_1: 1st minute of the painful procedure (p<0.001).
PP_2: 2nd minute of the painful procedure (p<0.001).
PP_3: 3rd minute of the painful procedure (p<0.05).
APP_1: 1st minute after the painful procedure (p<0.001).
APP_2: 2nd minute after the painful procedure (p<0.05).
PIPP: Premature Infant Pain Profile.

Discussion

This study showed that starting KC 30 minutes before and continuing it 10 minutes after an invasive procedure was effective in decreasing pain during and after the invasive procedure in premature infants.

For effective pain management in newborn infants, the presence of pain and its severity need to be reliably determined. In this context, it is important that pain assessment instruments be easy to use, multidimensional, and include behavioral and physiologic variables. The clearest sign of pain in newborns is crying. Crying has been accepted as a practical way to evaluate the severity and duration of pain[27,28]. However, in premature infants, it is thought that crying may not completely reflect the pain response[3,27]. PIPP is a commonly used and accepted method of evaluating procedural pain response in premature infants. PIPP includes both physiologic and behavioral variables in the pain response. It has been used in many studies for the evaluation of procedural pain in premature infants[29-32].

Premature Infant Pain Profile score between 0-6 points reflects mild, 7-12 moderate and 13-21 severe pain[25]. In this context, infants in the control group, who did not receive KC, had severe pain during the painful procedure and moderate pain after the procedure. Infants who received KC had moderate pain at the 1st minute of the painful procedure, and mild pain at the 2nd and 3rd minutes of the procedure. Pain was evaluated to be mild after the procedure in infants who received KC (Fig. 1). In a study by Gray et al.[24], pain response of newborn infants during an invasive procedure (heel blood sampling) who had been given KC for 10-15 minutes before the invasive procedure was compared to newborn infants who were swaddled, and KC was found to significantly decrease the severity of pain compared to swaddling. In a study by Johnston et al.[23], infants given KC during a heel blood sampling procedure were found to have significantly lower PIPP scores during the procedure than the control group. In a study by Ludington-Hoe et al.[3], the effect of KC before and during heel blood sampling procedure on decreasing pain was examined and it was determined that infants in the KC group cried less than the infants in the control group. In a study by Castral et al.[22], infants given KC during the heel blood sampling procedure had less behavioral pain response during the painful procedure than infants whose blood was taken while they were in their cribs. The physiological variables increased in both groups, but the increase was less in infants in the KC group in that study. In a study by Efe and Ozer[33], the effect of breastfeeding on pain during vaccination was examined and it was determined that duration of crying was less in breastfed infants compared to the infants who were not breastfed during the invasive procedure. The results of our study have shown that KC is a practical, easy and effective method for pain relief even in preterm infants.

There are many other methods used to stimulate various senses to decrease pain in newborn infants[10-12]. However, when newborns are in a painful and stressful situation, they need not only sensorial stimulation, but also to be with their mothers[34]. Therefore, KC may be the most effective method for decreasing pain and stress and for providing the maximum level of mother-infant interaction.

In conclusion, KC given before and during an invasive procedure has a positive effect on decreasing pain during and after the painful procedure in premature infants. It is recommended to encourage mothers to give KC to their preterm newborn infants before, during and after invasive procedures. Further studies should be planned to compare the effect of KC according to gestational age groups.

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