

Skin-to-Skin Care with the Father after Cesarean Birth and Its Effect on Newborn Crying and Prefeeding Behavior

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ABSTRACT: **Background:** Previous reports have shown that skin-to-skin care immediately after vaginal birth is the optimal form of care for full-term, healthy infants. Even in cases when the mother is awake and using spinal analgesia, early skin-to-skin contact between her and her newborn directly after cesarean birth might be limited for practical and medical safety reasons. The aim of the present study was to compare the effects of skin-to-skin contact on crying and prefeeding behavior in healthy, full-term infants born by elective cesarean birth and cared for skin-to-skin with their fathers versus conventional care in a cot during the first 2 hours after birth. **Methods:** Twenty-nine father-infant pairs participated in a randomized controlled trial, in which infants were randomized to be either skin-to-skin with their father or next to the father in a cot. Data were collected both by tape-recording crying time for the infants and by naturalistic observations of the infants' behavioral response, scored every 15 minutes based on the scoring criteria described in the Neonatal Behavioral Assessment Scale (NBAS). **Results:** The primary finding was the positive impact the fathers' skin-to-skin contact had on the infants' crying behavior. The analysis of the tape recordings of infant crying demonstrated that infants in the skin-to-skin group cried less than the infants in the cot group ($p < 0.001$). The crying of infants in the skin-to-skin group decreased within 15 minutes of being placed skin-to-skin with the father. Analysis of the NBAS-based observation data showed that being cared for on the father's chest skin-to-skin also had an impact on infant wakefulness. These infants became drowsy within 60 minutes after birth, whereas infants cared for in a cot reached the same stage after 110 minutes. Rooting activity was more frequent in the cot group than in the skin-to-skin group ($p < 0.01$), as were sucking activities ($p \leq 0.001$) and overall duration of wakefulness ($p < 0.01$). **Conclusions:** The infants in the skin-to-skin group were comforted, that is, they stopped crying, became calmer, and reached a drowsy state earlier than the infants in the cot group. The father can facilitate the development of the infant's prefeeding behavior in this important period of the newborn infant's life and should thus be regarded as the primary caregiver for the infant during the separation of mother and baby. (BIRTH 34:2 June 2007)

Key words: delivery ward routines, fathers, separation, skin-to-skin care, infant crying

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The effects of skin-to-skin contact between the mother and her healthy infant after vaginal delivery have been well studied during the past 25 years, and the first hours after birth have been found to be an important period for the development of mother-child interaction. Studies in the field have shown that skin-to-skin care of the newborn by the mother after birth is the optimal method of care (1–3).

Despite the reported benefits, direct skin-to-skin contact after birth is not universally practiced in the care of healthy, full-term infants. In fact, current routines exist today that separate the mother and her newborn infant as a common practice after cesarean birth (4). Even in cases when it is possible to have the mother awake with the use of spinal analgesia, early skin-to-skin contact between her and the newborn directly after birth is limited for practical and medical safety reasons. In a previous study examining skin-to-skin contact with the father for full-term, healthy infants, the paternal substitute was found to be as good as incubator care, according to infant body temperature after cesarean birth (5). The aim of the present study was to examine the effects of skin-to-skin contact on outcome, comparing its effects on crying and prefeeding behavior in healthy, full-term infants born by elective cesarean birth and cared for skin-to-skin with the father versus conventional care in a chair-side cot during the first 2 hours after birth.

Related Research

Newborn infants, whose mothers have not been exposed to interventions such as maternal analgesia, will crawl on the mother's breast (6) and use their hands to stimulate the breast in preparation for the first suckle (6–8). Rooting and mouth movements first appear very smooth and then become more and more target oriented. This development of the rooting and sucking reflexes has been described as the infant's prefeeding behavior, a need most probably preprogrammed in the child's brain (6,9). However, authors of previous studies have pointed out that there is reason to suspect that rooting and mouth movements after cesarean births are not the same as those for infants delivered vaginally by mothers not given analgesia during labor (10,11). In a previous report, Christensson et al showed a reduction in infant crying in infants cared for skin-to-skin with their mothers (12). In fact, the infant crying, the so-called separation distress call, stopped when the infant was reunited with his or her mother. Full-term, healthy infants who were kept with their mothers skin-to-skin also had higher body and skin temperatures than those who were carefully wrapped (12), swaddled, or dressed (13). Skin-to-skin

contact has also been shown to enable a more rapid metabolic adjustment, and generate higher levels of blood glucose, indicating that skin-to-skin care is the optimal care for full-term, healthy infants (12). Early skin-to-skin contact between the mother and child directly after cesarean birth is often limited (4). Furthermore, little research exists on fathers as primary caregivers during that time. However, an early care-providing relationship between father and infant was shown to have a positive emotional effect on fathers (14), an interaction shown to be supportive by mothers (15). Parke (16) further stated that parents are equally concerned about early care provision, and fathers want to be fully involved (17).

As a result of these positive findings on skin-to-skin care after birth, and together with an awareness of the increasing rates of cesarean birth as a method of delivery and parents' equal concern for care of the child (16,17), the need to investigate the influence of caregiving methods after cesarean birth further became apparent, with important attention to examining skin-to-skin care with the father versus conventional care in a chair-side cot.

Methods

Study Design and Population

A randomized controlled trial was carried out on a surgical and maternity ward at Karolinska University Hospital, Stockholm, Sweden. The following inclusion criteria for participation were applied: the cesarean birth was conducted at the 37th to 41st week of pregnancy, using a spinal analgesia with bupivacaine; the cesarean section was elective due to breech presentation, contraction of the pelvis, or a previous cesarean birth; and the newborn infant was assessed as healthy at the first checkup directly after birth. Demographic data on mothers and fathers were obtained from the maternal patient records and by means of questions posed to the fathers before data registration began. Demographic data of the infants were obtained from birth records.

Thirty-three parents were verbally informed of the study the day before the cesarean section, and informed written consent was obtained from 30 parents before enrollment. Three parent couples declined to participate, one for religious reasons, one because of language difficulties, and one as a result of previous experience of mother-infant separation. Thirty full-term infants were randomly assigned immediately after the cesarean section either to be skin-to-skin with the father or to receive conventional care in a cot next to the father. Before data registration

began, one father with an infant randomly assigned for the cot group declined further participation in the study because he wanted to be "skin-to-skin" with his infant. This father-infant couple was therefore excluded from further analysis since no data were gathered. Two infants were transferred to the neonatal intensive care unit for medical reasons before data collection was finished. One infant in the cot group was transferred 82 minutes after registration because of high heart rate, and one infant in the skin-to-skin group was transferred because of hypoxia 60 minutes after registration. Data gathered from these 2 infants are included in the analysis. The medical diagnosis for both infants was prolonged pulmonary adaptation, and they were reunited with their mothers on the postnatal ward, one infant on the first day postpartum and the other on the fourth day postpartum. Thus, data were collected from 15 father-infant pairs participating in the skin-to-skin group and 14 father-infant pairs participating in the cot group.

In a previous report on separation distress call in the absence of maternal body contact (9), a similar sample size was sufficient. In the present study, to detect a difference between the groups with respect to the number of tape-recorded crying periods having a type I error of 0.05 and a power of 0.80, we calculated that at least 11 participants were required for each group, if the difference in mean value was 5.0 seconds and the standard deviations were 4.0. Randomization was performed using sealed, opaque envelopes. The Regional Ethics Committee at Karolinska University Hospital, Stockholm, approved the study. Informed written consent was obtained from parents before enrollment.

Assessment of Infant Behavior

The human infant's distress call is described as crying that takes place when the infant is physically separated from the mother (9). The target-oriented development of rooting, mouth movements, and sucking reflexes is described as the infant's prefeeding behavior (6).

To study postnatal and prefeeding behavior in the present study, items from the Neonatal Behavioral Assessment Scale (NBAS) developed by Brazelton and Nugent (18) were selected to record rooting and sucking and states of wakefulness. The NBAS was first published in 1973 and has since been used for research purposes with a 90 percent interrater reliability level when used by trained examiners (18). In the present study, NBAS observations were made by a certified Newborn Individualized Developmental Care and Assessment Program (NIDCAP) observer (19),

who qualified in 1994 at Harvard Affiliated Teaching Medical School. The NBAS observer and examiner (A.D.) has had many years experience of advanced clinical and research practice (18) observing and coding behaviors of preterm and full-term infants. Before the present study began, NBAS observations were made by the principal investigator (K.C.) and the trained NBAS examiner (A.D.) until interobserver agreement was established.

During the naturalistic observation of the infant, the examiner scored the predominant behavioral expressions, on the selected items of wakefulness and prefeeding behavior, for each infant during the first minute of every 15-minute period throughout the study period. The tool used was based on the scoring criteria described in the NBAS, with some modifications concerning the infant's state. The rationale for the modifications derived from the fact that the state of the newborn infant could shift quickly and that the time factor posed problems in reaching agreement between the principal investigator and the examiner during the training period before the study was started. Therefore, in the present study, the 2 sleep states of the NBAS, states 1 and 2, were collapsed into "sleep states" (code 1). The state "drowsy" was unmodified from the NBAS (code 2). The NBAS "awake" states 4 and 5 were collapsed into "awake state" (code 3). The state "crying" was derived from NBAS state 6 (code 4). In the present study, an addition to the NBAS definition of crying was made to clarify the distinction between crying and fussing; our new definition included a necessity to see the typical crying face with "cupped tongue." This specific behavioral expression is described and defined in the Distress Scale for Ventilated Newborn Infants (20). The scoring scheme for assessing wakefulness, rooting, and sucking (18) is presented in Table 1.

In addition to the naturalistic observations, the infant vocalizations were measured to analyze the duration of infant crying. A "tie-microphone" (Sony ECM-144, Tokyo, Japan) was placed 10 cm from the infant's mouth on the outermost towel covering the infant and was connected to a tape recorder (Sony TCS, Tokyo, Japan). A midwife, who was blinded to the infants' group assignment, was employed for the analysis of tape recording, which took place when all material was collected. Before analysis of the tape recording began, the event of crying in the tape-recorded material was defined as intense crying without time limit (9).

Study Protocol

Immediately after cesarean delivery, the umbilical cord was cut and the infant was then wrapped in 2

towels and shown to the mother. Thereafter, the child was taken out to an open incubator, was wiped off, and if needed, oral suctioning of mucus from the mouth was performed. Then, as soon as possible, the child was returned to the mother in the surgery room and placed on her chest, still wrapped in towels. During this procedure, the father was near his child all the time. After being on the mother's chest for 5 to 10 minutes, the infant was transferred to a nearby maternity unit together with the father while the mother was transferred to the postsurgery ward for observation.

During the intervention time, infants were either cared for in a conventional way in a cot, with their father present in the same room sitting on a chair beside the cot ($n = 14$), or were cared for skin-to-skin on their father's chest, as he was comfortably seated in an armchair ($n = 15$). The fathers in the skin-to-skin group and the cot group received the same informa-

tion except that the fathers in the cot group were instructed not to pick up the child from the cot. The fathers were free to get to know the child as they would "naturally" do and thus interact with the wakeful child. The fathers could freely console when they thought this necessary. After the intervention period, the fathers in both groups were free to interact and pick up their infants as they wished while waiting for the mother to be reunited with their infants.

Two blankets covered the infants placed skin-to-skin with their fathers, whereas the infants kept in a cot were wrapped with 2 blankets. The predominant behavioral expressions of wakefulness and prefeeding behavior, according to the NBAS-based protocol, were scored during the first minute of every 15-minute period. The first scoring of infant behavior was made immediately before the microphone was attached, and the tape recording of the infant vocalizations started.

Table 1. The NBAS-Based Scoring Scheme for Assessing Infant Behavior, Including Scoring Criteria for Wakefulness, Rooting, and Sucking, with Respective Code Numbers (18)

<p>Code 1: Sleep State NBAS States 1 and 2 NBAS state 1: Deep sleep with regular breathing, eyes closed, no spontaneous activity</p>	<p>Code 2: Drowsy NBAS State 3 Drowsy or semidozing; eyes may be open, dull and heavy lidded, even closed; activity level variable, reactive to sensory stimuli, but response is delayed; state change after stimulation frequently noted; movements are usually smooth; dazed look when the infant is not processing information and is not fully alert</p>	<p>Code 3: Awake NBAS States 4 and 5 NBAS state 4: Alert, with bright look; the infant seems to focus attention on source of stimulation; motor activity is at a minimum; a kind of glazed look exists, which can be easily broken through</p>	<p>Code 4: Crying NBAS State 6 Intense crying, which is difficult to break through with stimulation; motor activity is high; in addition to the definition of NBAS, the typical crying face with cupped tongue should be seen</p>
<p>NBAS state 2: Light sleep with eyes closed; rapid eye movements could be observed, low activity level</p>		<p>NBAS State 5: Eyes open; considerable motor activity with movements of the extremities, reactive to external stimulation with startles and motor activity</p>	
<p>Code 0: rooting absent NBAS score 0 is defined as no lip or tongue movements</p>	<p>Code 1: rooting low NBAS score 1 is defined as only a weak turn or lip movement and/or slight tongue protrusion</p>	<p>Code 2: rooting medium NBAS score 2 means turn to stimulated side; mouth opens and grasps; lips may curl to stimulated side</p>	<p>Code 3: rooting high NBAS score 3 presents obligatory rooting, grimacing with mouthing movements, which do not subside</p>
<p>Code 0: sucking absent NBAS score 0 is defined as no sucking movements at all</p>	<p>Code 1: sucking low NBAS score 1 is weak or barely discernible suction</p>	<p>Code 2: sucking medium NBAS score 2 is modulated, rhythmic suck</p>	<p>Code 3: sucking high NBAS score 3 means exaggerated, obligatory suck that does not decrease over time</p>

Statistics

The observation samples of each infant were compared in a univariate analysis (21) to become familiar with the material. Using a bivariate analysis (21), the skin-to-skin group was compared with the cot group by tape-recorded crying time and the NBAS-based observation of wakefulness, rooting, and sucking. The differences between the skin-to-skin group and the cot group were tested using the Mann-Whitney *U* test, all data inclusive, but a separation was made between the wakefulness, rooting, and sucking observation data and the data from the analysis of the recorded crying time. The statistical presentation of the mean values and confidence interval for the recorded crying data, and the mean values and standard deviation scores for the NBAS-based observations, includes all data. Statistical significance was set at 0.05. All data analyses were performed using SPSS for Windows Standard Version 11.5 (22).

Data were also registered in relation to time after birth for each infant according to tape-recorded crying time (Fig. 1) and the observations based on NBAS scoring criteria (Table 1) of wakefulness, rooting, and sucking (Figs. 2, 3). For the presentation of data during the period from 35 to 120 minutes after birth, the mean values were calculated for every 5-minute period for the tape-recorded crying data (Fig. 1) and for every 15-minute period for the NBAS-based data (Figs. 2, 3) to compare the skin-to-skin group with the cot group. The time limit was set for the reason that all participating children were observed during that time, and after that time, the number of observa-

tions declined. In addition, 3 periods were chosen from the tape-recorded data to represent crying time: 35 to 40, 55 to 60, and 85 to 90 minutes after birth. The rationale for selecting these time sequences was to enable comparison of the results with those of a previous study on separation distress call in the absence of maternal body contact (9).

Results

No significant statistical differences between the 2 study groups were found with respect to demographic characteristics for infant, maternal, or paternal data (Table 2).

The data from the tape recordings of infant crying time in seconds were analyzed using several 5-minute periods from 35 to 135 minutes after birth. For the skin-to-skin group, the total number of 5-minute periods was 221, and for the cot group, the total number of 5-minute periods was 162.

The analysis of the tape-recorded infants crying (Fig. 1) demonstrated that the infants in the skin-to-skin group cried significantly less than the infants in the cot group ($p < 0.001$). Mean crying time ($\pm 95\%$ CI) for the skin-to-skin group was 13.4 (± 3.60) compared with a mean score of 33.4 (± 6.61) seconds per 5-minute period for the cot group. Mean crying time for the time periods of 35 to 40, 55 to 60, and 85 to 90

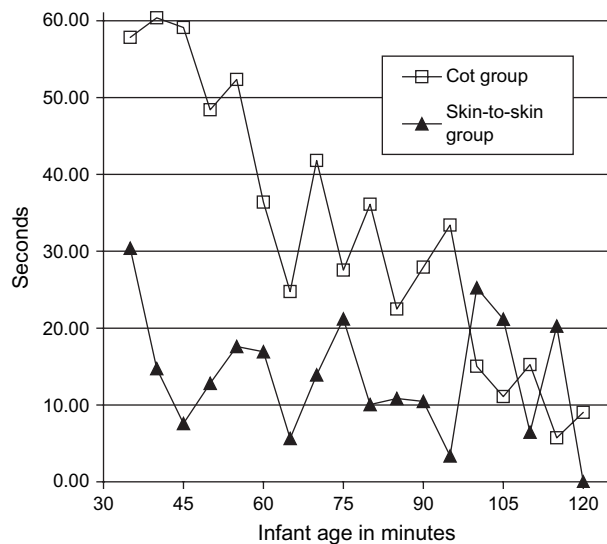


Fig. 1. The infants' cry analyzed as mean seconds per 5-minute periods from tape-recorded data.

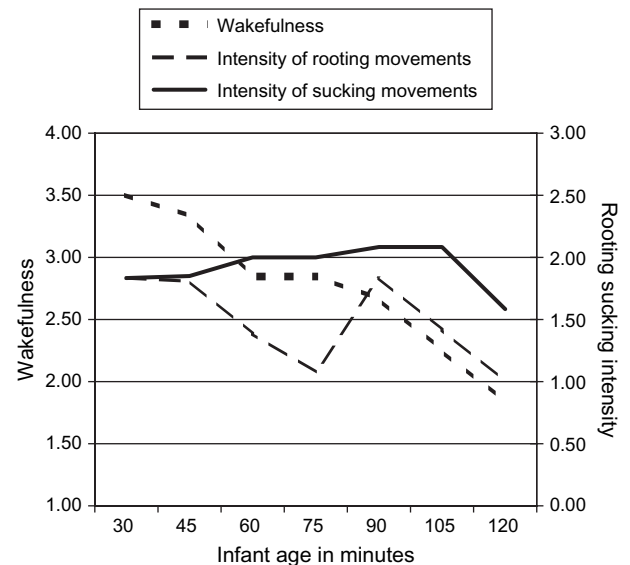


Fig. 2. Cot group: the infants' observed wakefulness, rooting, and sucking analyzed as a mean value on the implemented Neonatal Behavioral Assessment-based Scale. Wakefulness codes: 1 sleep state, 2 drowsy, 3 awake, and 4 cry. Rooting and sucking codes: 0 absent, 1 low, 2 medium, and 3 high.

minutes after birth was 30.4, 17.6, and 10.8 seconds, respectively, per 5-minute period for the skin-to-skin group, whereas for the cot group, the mean crying time in the same respective periods was 57.8, 53.3, and 22.5. As shown in Fig. 1, the infants in the cot group cried less as time passed ($p < 0.001$), whereas the crying of infants in the skin-to-skin group decreased rapidly (within the first 15 min) after being put skin-to-skin with their fathers.

The NBAS-based observations for the skin-to-skin group were conducted over a period of 30 to 145 minutes after birth, with a total number of 91 observations for each observed behavior. For the cot group, the observations were conducted over a period of 30 to 139 minutes, with a total number of 83 observations for each observed behavior. The total mean value, standard deviation scores, and p values for the NBAS-based outcome behaviors, wakefulness, rooting, and sucking are presented in Table 3.

The pattern for wakefulness showed a lower level for the skin-to-skin group when compared with the cot group ($p < 0.01$), as shown in Figs. 2 and 3, after having a similar state of wakefulness at the beginning of the observation period. The skin-to-skin care infants were in a drowsy state, according to the NBAS-based scoring criteria, within 60 minutes, whereas the infants cared for in cots reached the same level after 110 minutes.

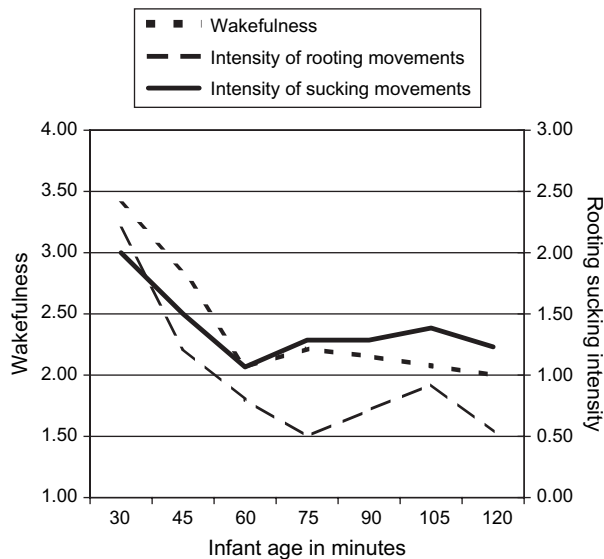


Fig. 3. Skin-to-skin group: the infants' observed wakefulness, rooting, and sucking analyzed as a mean value on the implemented Neonatal Behavioral Assessment-based Scale. Wakefulness codes: 1 sleep state, 2 drowsy, 3 awake, and 4 cry. Rooting and sucking codes: 0 absent, 1 low, 2 medium, and 3 high.

The rooting patterns in the skin-to-skin group and the cot group were similar, but the skin-to-skin group generally showed a lower level ($p < 0.01$). At 75 minutes of age, infants in both groups showed their lowest level of rooting activities (Figs. 2, 3). The skin-to-skin group reached another weak rooting peak after 105 minutes, whereas the cot group reached a second active rooting peak after 90 minutes, as shown in Figs. 2 and 3. The infants in the cot group showed a steady medium level of sucking activity, which declined 105 minutes after birth compared with the level in the infants in the skin-to-skin group, which declined within 60 minutes after birth ($p \leq 0.001$). The sucking activities for the cot group declined 105 minutes after birth. Sucking activities declined for both groups at the same time as a decrease in wakefulness was noted (Figs. 2, 3).

Discussion

The primary study finding was the positive impact the fathers' skin-to-skin contact had on infant crying behavior. The analysis of the tape recordings of the infants crying (Fig. 1) demonstrated that the infants in the skin-to-skin group cried less than the infants in the cot group. Analysis of the NBAS-based (18) observations (Figs. 2, 3) showed that being cared for skin-to-skin on the father's chest also had an impact on wakefulness, and on rooting and sucking, as illustrated by the fact that infants cared for skin-to-skin became calm and reached a drowsy state within 60 minutes after birth, whereas the infants cared for in a cot became calm and reached drowsy state within 110 minutes after birth. Therefore, the opportunity for father-infant interaction was presented during a shorter period of calm wakefulness when cared for skin-to-skin, rather than a longer period of wakefulness with more crying when cared for in a chair-side cot. Rooting activity was higher in the cot group than in the skin-to-skin group, as was the sucking activity and overall wakefulness. Skin-to-skin contact seems to facilitate coordination of the prefeeding behavior.

A randomized controlled trial study design was chosen, since the design was considered to be the least biased, and no significant statistical difference was shown in background variables between either of the 2 groups or in the variables studied at the starting point of observation. However, one limitation of the study was that the observations of wakefulness, rooting, and sucking could not be blind. Another limitation was that no interreliability tests were performed during the study period. To ensure the initial definitions of behaviors selected for the study (i.e., consistency of collection format), however, the data

collection in the present study was performed by a certified NIDCAP observer (A.D.), with advanced clinical and research practice in observing and coding behaviors in both preterm and term infants. In addition to obtain an appropriate interobserver reliability, NBAS observations were made by the principal investigator (K.C.) and by the NBAS observer (A.D.) until interobserver agreement was established before the study began.

It is possible that the observer could have made subjective observations, despite having been trained in using the NBAS (18). Nevertheless, the tape recording of crying could be perceived as an objective instrument since the person analyzing the tapes was not aware of how each infant had been cared for; the power was found to be more than 80 percent, as required. Validity and reliability were strengthened by the fact that the results in the present study are in line with other studies in the field (21).

Crying Behavior

The results from our study are similar to those reported by Christensson et al (12), who measured crying time for infants cared for skin-to-skin with the mother or cared for in a cot in three 5-minute

observation periods at 25 to 30, 55 to 60, and 85 to 90 minutes after birth. They found that the mean crying time was 0.0, 0.0, and 0.6 seconds, respectively, for the skin-to-skin group, and 72.9, 65.6, and 50.0 seconds, respectively, for the cot babies. Our findings varied from this earlier study when compared with results for skin-to-skin care with the mother, whereas the cesarean birth infants in our study cried more when placed skin-to-skin with the father at about the same time after birth. The mean crying time 35 to 40 minutes after birth was 30.4 seconds, then in the same periods as above 17.6 and 10.8 seconds, respectively, per 5-minute period.

The differences in crying levels in these 2 studies may be due to several reasons, including exposure to anesthesia, lower levels of catecholamine, lack of exposure to maternal odor (except for amniotic fluid on the babies hands and body), or differences in the way mothers and fathers behaved toward their newborn infant. Variations in crying levels might be due to spinal analgesia with bupivacaine, which Ransjö-Arvidson et al (11) assumed increased crying, when they compared effects of epidural on infants delivered by mothers who had not received analgesia during labor. Alternatively, infants delivered by means of elective cesarean section have been demonstrated to show significantly lower levels of catecholamine

Table 2. Demographic Data for Participants

<i>Demographic Data</i>	<i>Skin-to-Skin Group</i>	<i>Cot Group</i>	<i>p</i>
Infants			
Sex	9 girls, 6 boys	8 girls, 6 boys	—
Mean birthweight (g)	3,173 (SD = 560)	3,449 (SD = 408)	0.06
Gestational age (wk)	38.7 (SD = 0.99)	38.8 (SD = 0.87)	0.74
Apgar score at 5–10 min	9–10	9–10	—
Mothers			
Mean age (yr)	33.1 (SD = 5.4)	33.1 (SD = 4.3)	0.81
Average parity (number)	2.4 (SD = 1.1)	2.2 (SD = 1.1)	0.51
Fathers			
Mean age (yr)	34.7 (SD = 5.9)	36.2 (SD = 6.7)	0.48
Average own infants (number)	2.7 (SD = 1.3)	2.3 (SD = 1.4)	0.22

Table 3. Total Scores for NBAS-Based Outcome Behaviors, Wakefulness, Rooting, and Sucking (18)

<i>Code</i>	<i>Skin-to-Skin Group</i>		<i>Cot Group</i>		<i>p</i>
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	
Wakefulness, codes 1–4	2.24	1.17	2.69	1.07	0.009
Rooting pattern, codes 0–3	0.86	1.28	1.46	1.25	0.002
Sucking activities, codes 0–3	1.29	1.35	1.93	1.15	0.001

NBAS = Neonatal Behavioral Assessment Scale.

(adrenalin and noradrenalin) than vaginally delivered infants (23).

We have not found any studies that examine how lower levels of stress-related hormones affect infant crying and prefeeding behavior after cesarean birth, and this subject therefore requires further investigation. Comfort response has been described as discontinuation of the separation distress call on reunion with the mother (9) and when other needs are met, for example, response to infant behavior. One could speculate that if the calmness in the drowsy state is a result of comfort response when the babies are skin-to-skin with the father, this behavior could reflect the baby's shift from the sympathetic to the parasympathetic "gain and grow metabolic state" with conservation of the infant's energy stores (13). Catecholamine and early skin-to-skin contact have also been proposed as being important for an infant to be able to recognize his or her mother's milk odor and for longer breastfeeding duration (24). All infants in the present study were unexposed to "mother odor," except for the first 5 to 10 minutes immediately after birth and the amniotic fluid on the baby's hands and body, which has been proved to have an effect on both crying and prefeeding behavior (25). Could it be that the smell of the familiar amniotic fluid on the infant's hands and body makes the infant cry less and therefore helps with the infant's transition to the father and his or her return to the mother?

In addition, one can reflect on the impact that individual fathers' care for their infants might have had on the wakefulness and crying levels. The fathers were free to interact with the baby, but no data were gathered on caring variables, such as how much they touched, sang, or talked to the infant. Since fathers were free to "get to know" their new baby, our understanding of the bonding process suggests that most new fathers would be primed to interact with their infants and engage them in mutual gaze behavior. Prolonged wakefulness provides fathers and babies with an opportunity to get to know each other and could be seen as a positive outcome (26). If the fathers had been initially instructed to calm the baby, they may well have been concentrated on getting the baby to sleep and that might have had an influence on the results of the present study. We believe the fathers assumed, from the instructions given, that they could "bond" as they would "naturally" during examining the effects of the intervention (26).

The results of our study indicate that the opportunities for father-infant interaction are presented during a shorter qualitative period of calm wakefulness when infants are cared for skin-to-skin, rather than a longer period of wakefulness with more crying when cared for in a chair-side cot. The period of calm wake-

fulness for the skin-to-skin group of babies is in line with previous studies of the period of alertness when the infants look at their parents' faces and eyes and respond to their voices in the first hour after birth (26,27).

The infants in the skin-to-skin group became drowsy about 1 hour after birth, according to the NBAS-based (18) observations. Since sleep is important for the baby's recovery from being born, drowsiness and return to sleep after the period of wakefulness is a positive outcome (26).

Similar to the findings in our previous study (9), infants in the present study stopped crying after being separated and cared for skin-to-skin with the parent and indicated a comfort response within 15 minutes of care being given. The infants in the cot group were still crying at that time, although the fathers were placed close to their children, with the opportunity to caress the child by means of touching, helping the infant to suck either the infant's or the father's finger, or by singing. In our previous study (9), the infant's distress call stopped immediately when the infants were reunited with their mothers. The infants placed in cots in the present study cried less than the infants placed in cots in the previous study (9). However, in that study, mothers did not have access to the infant.

Prefeeding Pattern

The infants in the present study showed a similar prefeeding pattern, as illustrated by rooting and sucking activities, although these were prolonged in relation to birth when compared with the results of Widström et al (6), who demonstrated that rooting activities decreased in both groups after 75 minutes; this finding was similar to that of another study (8). Further speculation for prefeeding behavior may include the possibility that the effects of spinal analgesia with bupivacaine may have a profound influence on this behavior. Ransjö-Arvidson et al (11) proposed that in their study nearly half of the group with mothers who had been given analgesia during birth did not suck on the breast until 2.5 hours after delivery. One should remember, however, that spinal and epidural analgesics do not necessarily have the same effect.

The wakeful, crying, and actively sucking and rooting infants in the cot group might indicate that this group was less satisfied. The decrease in rooting may not have been the result of comfort response, but possibly of fatigue or tiredness, and after a while they gained some new strength and started to root again to reach a second rooting peak after 90 minutes. Our implemented NBAS-based scoring system for the "awake" state did not differentiate between NBAS

stages 4 and 5. The length of time the cot babies spent in NBAS stages 4 and 5 might possibly have affected their tiredness and prefeeding behavior (13). Infants in this group also continued with sucking movements even after rooting movements decreased. During the data collection period, all infants were observed to root and find their hand or fingers or the skin of the father's chest or even the father's nipple to suck on. One can speculate whether or not cot care disturbs or does not facilitate the relations of the breastfeeding reflexes. However, skin-to-skin contact seems to facilitate coordination of the prefeeding behavior.

Caring Implications and Further Research

The results of this study demonstrated that skin-to-skin contact with the father is optimal for the infant's well-being when the mother and infant are separated after a cesarean birth. Postpartum care that provides for infants to be placed skin-to-skin with the father is therefore recommended when skin-to-skin contact with the mother is not available.

Fathers must further contend with the newborn infant's ongoing prefeeding behavior during the mother-baby separation, which may be a topic for discussion on antenatal courses and a foundation for routine implementation for cesarean-delivered infants. In caring work, it would be interesting in a larger study to allow for data collection to also encompass reunion with mothers. The hypothesis would be that infants cared for skin-to-skin with their fathers during maternal separation would conserve energy by crying less. The infant might therefore be more energetic toward another rooting peak on being reunited with the mother and find her nipple for their first suckle earlier than infants who had not been cared for skin-to-skin with their fathers during mother-baby separation. Caring practice where mother and infant can stay together with the father during this period of life is recommended.

Conclusions

The infants in the skin-to-skin group indicated comfort response within 15 minutes of care being given. They stopped crying and became peaceful earlier than infants in the cot group. The babies with skin-to-skin contact reached the drowsy state, as based on Neonatal Behavioral Assessment Scale scoring criteria, within 60 minutes compared with approximately 110 minutes for infants cared for in a cot. This valuable information can be used to encourage fathers to provide skin-to-skin care for their babies. Although

a father cannot breastfeed a baby, he can facilitate the development of the infant's prefeeding behavior in this important period of the newborn infant's life, and he should thus be seen as the primary caregiver for the infant during the separation of mother and baby.

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