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Skin-to-Skin Contact After Cesarean Delivery

An Experimental Study

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▶ ***Background:*** The effectiveness of skin-to-skin contact (SSC) after vaginal delivery has been shown. After cesarean births, SSC is not done for practical and medical safety reasons because it is believed that infants may suffer mild hypothermia.

▶ ***Objective:*** The aim of this study was to compare mothers' and newborns' temperatures after cesarean delivery when SSC was practiced (naked baby except for a small diaper, covered with a blanket, prone on the mother's chest) with those when routine care was practiced (dressed, in the bassinet or in the mother's bed) in the 2 hours beginning when the mother returned from the operating room.

▶ ***Methods:*** An experimental, noninferiority adaptive trial was designed with four levels of analysis: 34 pairs of mothers and newborns, after elective cesarean delivery, were randomized to SSC (n = 17) or routine care (n = 17). Temporal artery temperature was taken with an infrared ray thermometer at half-hour intervals.

▶ ***Results:*** Compared with newborns who received routine care, SSC cesarean-delivered newborns were not at risk for hypothermia. The mean temperatures of both groups were almost identical: after 30 min, 36.1°C for both groups (±0.4°C for SSCs and ±0.5°C for the controls), and after 120 min, 36.2°C ± 0.3°C for SSCs versus 36.4°C ± 0.7°C for the controls (no significant differences). Time from delivery to the mothers' return to their room was 51 ± 10 min. The SSC newborns attached to the breast earlier (nine SSC newborns and four controls after 30 min) were breast-fed (exclusively or prevalently) at discharge (13 SSCs and 11 controls) and at 3 months (11 SSCs and 8 controls), and the SSC mothers expressed high levels of satisfaction with the intervention.

▶ ***Discussion:*** Cesarean-delivered newborns who experienced SSC within 1 hour of delivery are not at risk for hypothermia.

▶ ***Key Words:*** breast-feeding · cesarean section · full-term newborns · skin temperature · skin-to-skin

Skin-to-skin contact (SSC) is the positioning of the naked baby prone on the mother's bare chest, immediately or in the very first hours after birth (Moore, Anderson, & Bergman, 2007). A Cochrane Collaboration systematic review (Moore et al., 2007) showed the efficacy of SSC on the baby's thermoregulation (Bergman, Linley, & Fawcus, 2004; Chiu, Anderson, & Burkhammer, 2005; Fransson, Karlsson, & Nilsson, 2005), breast-feeding (Carfoot, Williamson, & Dickson, 2003; Jonas, Wiklund, Nissen, Ransjö-Arvidson, & Uvnäs-Moberg, 2007; Moore et al., 2007), bonding (Feldman, Eidelman, Sirota, & Weller, 2002; Klaus et al., 1972; McClellan & Cabianca, 1980; Tessier et al., 1998), and development and, overall, on the general well-being of mothers and infants. No negative effects were observed on respiratory control and thermoregulation (Bohnhorst, Heyne, Peter, & Poets, 2001). The World Health Organization (WHO) guide on kangaroo mothers' care (Gruppo di Studio della SIN, 2006; WHO, 2003) recommends SSC for all newborns, irrespective of context, weight, gestational age, and clinical conditions.

Skin-to-skin contact is well known and implemented widely in full-term infants born by vaginal delivery (WHO, 1997), but major obstacles persist after cesarean births (Erlandsson, Dsilna, Fagerberg, & Christensson, 2007), for practical and safety reasons. The main difficulty in promoting SSC, also in vaginally delivered children (Chiu et al., 2005), is the potential for hypothermia: a skin temperature of 36°C–36.4°C is defined as mild hypothermia (WHO, 1997). Hypothermia occurs throughout the world and in all climates and it is more common than expected. Heat loss increases with air movement, and a baby risks getting cold even at a room temperature of 30°C if there is a draft (WHO, 1997).

The main data on hypothermia derive from studies on preterm infants: Bergman et al. (2004) showed that for infants having a birth weight between 1,200 and 2,199 g exposed to SSC, the risk of hypothermia is significantly reduced compared with conventional incubator care; all SSC

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participants were stable in the 6th hour compared with 6/13 incubator infants.

Extended periods of cold stress may cause harmful side effects such as increased oxygen consumption, and this can lead to acidosis and hypoglycemia, a fall in blood pressure, decreased plasma volume and cardiac output, and increased peripheral resistances (Knobel & Holditch-Davis, 2007). Hypothermia also may cause coagulation defects, delayed readjustment from fetal to newborn circulation (McCall, Alderdice, Halliday, Jenkins, & Vohra, 2008). After birth, there is a rise in the newborn's temperature due to the increase in metabolic rate (Christensson et al, 1992), but most cooling occurs in the first 10–20 minutes after birth (WHO, 1997).

Babies delivered via cesarean are at higher risk for hypothermia.

Babies delivered via cesarean are at higher risk for hypothermia because of (a) the low temperature of the operating room, (b) the mothers themselves, or (c) the locoregional anesthesia (Hui et al., 2006; Peillon, Dounas, Lebonhomme, & Guittard, 2002; Saito, Sessler, Fujita, Ooi, & Jeffrey, 1998); (d) the redistribution of body heat from core to periphery (Horn et al., 2002), with a typical decrease in core temperature of 0.5°C–1°C (Arkiliç, Akça, Taguchi, Sessler, & Kurz, 2000); and (e) the newborn, especially in the first 90 minutes, compared with full-term vaginally delivered newborns. Infants delivered by cesarean section are exposed to drugs that may affect thermoregulation, and the sympathoadrenal system is not mobilized to the same extent as in vaginally delivered infants (Christensson et al., 1993). Only two trials on SSC were found to have included cesarean-delivered healthy infants, assessing mothers' perception of their babies after SSC in the first 12 hours after delivery (McClellan & Cabianca, 1980) and the effect of SSC with the father on crying and prefeeding behavior (Erlandsson et al., 2007). Cesarean-delivered babies generally are not included in studies; therefore, scarce information exists on the effect of SSC on this population. In addition, due to the increasing number of cesarean births, the Cochrane review recommends further research on SSC after cesarean delivery (Moore et al., 2007).

The aim of this study was to assess the safety of early SSC after cesarean delivery on newborns' temperature in the 2 hr after the mothers return from the operating room. Secondary end points were the assessment of the benefits of SSC on first attachment to breast, minutes postbirth of first attachment, crying, breast-feeding at discharge and after 3 months, and maternal satisfaction with SSC. The hypothesis was that there would be no differences in temperature variations between infants exposed to SSC or to usual care.

Methods

This study was conducted in the Mother and Child Department of Pinerolo Hospital (Turin, Italy), which averages 1,200 deliveries per year. In 2006, out of 1,098 deliveries, 309 (28.1%) were cesarean sections. There were 55.6% exclusively breast-fed infants at discharge after cesarean births and 66.2% for spontaneous vaginal deliveries.

A design described by O'Brien and Fleming (1979) was used in this noninferiority adaptive trial that began on February 13 and ended early in August 2007. The maximum number of patients needed was established, but sequential levels for analysis were designed (Bauer, 1989) to identify any risk of hypothermia promptly. Four levels for analysis were planned (O'Brien & Fleming, 1979). The mother–newborn pairs were randomized to SSC or to routine care. Italian women scheduled for elective cesarean delivery with locoregional anaesthesia were recruited from the maternity ward of Pinerolo Hospital. Only cesarean births with full-term newborns were eligible (38–42 weeks gestation, 1- and 5-min Apgar scores $\geq$7, weight >2,500 kg).

A meeting was held with 13 nurses and health care personnel involved in the study to discuss the protocol and train for data collection, including the use of scales.

Sample

A maximum of 68 women–newborn pairs per arm was calculated to give 80% power at the 5% significance level to show a mean difference of temperature more than 0.1°C. This value was agreed on after a consensus meeting with the neonatologists of the ward and based on the results obtained from a pilot study (data not published) on 21 newborns in which the standard deviation of temperatures was 0.4°C. According to the adaptive design, four interim analyses were planned, after 17 pairs per arm. After each step, the null hypothesis can be rejected at increasing levels of significance (depending on the α function employed) or accepted with a Student's t test for paired samples. The protocol was approved by the local ethical committee.

Randomization

If women met the inclusion criteria, they were approached at around 36–37 weeks, at their scheduled checkup, the week before their elective delivery. They were informed about the study, verbally and with an information sheet, and were asked to sign an informed consent form. Mothers were then randomized using opaque, sealed envelopes, each containing the next allocation, from a computer-generated randomization list. Confidentiality was guaranteed.

The day of surgery, the nurse opened the envelope. When the baby was back from the operating room, the father or the closest relative was then informed of the group allocation (routine care or SSC). The mother was informed when she returned to her room.

Interventions

After the umbilical cord had been cut and a general assessment of the newborn and the Apgar score were completed, infants of both groups were dried, wrapped in a towel, handed to their mother for a brief contact, and transported to the neonatal ward in an incubator. The staff pediatric nurse (with the father or a relative) inspected the infant, bathed and dried it, and weighed it. Average time elapsed from birth to the newborn's arrival to the room

was 51 ± 10 min. After surgery, the mothers were transported to the obstetrical ward.

Newborns assigned to routine care were bathed, dried, and dressed and held by the father or put in the radiant warmer if there were no relatives or considered hypothermic; then, if not contraindicated, the infant was taken to the mother's room when she returned. The mother was instructed on how to breast-feed and, during the 2-hr observation time, could choose whether to keep the baby in her bed, in a crib next to the bed, or in the neonatal center. She could choose whether to breast-feed or not.

The newborns assigned to SSC received the same treatment, but they were not dressed; they were fitted with a disposable diaper and a cap and wrapped in a warm cloth. When the mother was back in her room, the newborn was placed on the mother's skin, between her breasts, and left covered with the cloth, the bed sheet, and blanket for a maximum of 2 hr. During this time, the mother was instructed on how to breast-feed.

No changes in practices occurred during the time of the study.

Skin Temperature Skin temperature in both groups was taken at arrival from the operating room, after the bath, when the mother returned to the room, and every half hour for 2 hr, with an infrared ray thermometer on the forehead (THERMOFOCUS, 01500 series, Tecnimed, Varese, Italy) that measures the temperature without skin contact. This technique provides reliable results (Martin & Kline, 2004; Matsukawa, Ozaki, Nishiyama, Imamura, & Kumazawa, 2000). The same model was used for the mother's and room temperature. Three dedicated thermometers were used for mothers and newborns.

Breast-Feeding The nurses measured the effectiveness of the first breast-feeding session with the Infant Breastfeeding Assessment Tool (IBAT; Matthews, 1988). Measures were readiness to feed, rooting (at the touch of the nipple to cheek, the baby opens his or her mouth and tries to grasp the nipple), sucking, and latching onto the breast. Each behavior is assessed on a 3-point Likert scale, with a possible total score ranging from 0 to 12. The mother's satisfaction for breast-feeding does not add to the score. The mothers could choose when to start breast-feeding and for how long; time to first attachment was measured. The first attachment was effective if the score was ≥8.

Exclusive Breast-Feeding at Discharge Data were collected from clinical and nursing records. Breast-feeding was considered exclusive if only mother's milk had been offered in the last 24 hr before discharge (WHO, 1998). After 3 months, women were contacted by telephone to collect information on feeding in the first 3 months.

Satisfaction Mothers and fathers in the SSC group were asked to complete together a questionnaire with seven close-ended questions on a 5-point Likert scale (from *not at all* to *complete agreement*). The questionnaire is used to assess the mothers' perceptions of difficulties, negative effect on father, positive effect on mother–baby interaction and discomfort, the father's feeling of exclusion and the effect on his attachment, improvement of the relationship with the baby, and willingness to continue SSC at home or to recommend it to other mothers.

Data Analysis

Data were analyzed on an intention-to-treat basis. Means, mean differences, and standard deviations were calculated and statistical analysis was done using Student's *t* test for paired samples, according to the adaptive design protocol, after the first 17 pairs per group.

Results

From February to August 2007, out of 170 cesarean births, 96 women (56%) had an elective cesarean delivery. Fifty-five women were not contacted because of organizational difficulties, unavailability of nurses, or lack of time ($n = 25$) or because they did not attend the hospital clinic for preadmission check-up and blood tests ($n = 30$) and therefore could not be asked for consent before delivery. Of the 41 women contacted, 2 did not consent to the study and 3 had an unscheduled cesarean section (Figure 1). Of the 36 randomized women, 1 woman in the SSC group withdrew consent and 1 woman in the control group was sedated and therefore excluded. Data are presented on 34 mother–child couples (17 SSC and 17 controls). The mothers' and newborns' main characteristics are presented in Table 1.

The main indication to elective cesarean delivery was a previous cesarean (10 SSC newborns, 8 controls) or a breech presentation (5 in both groups). The two groups were comparable; no intrapartum complications occurred and no newborns needed resuscitation support. Only one woman in the control group had hypotension during surgery, but her blood pressure had returned to normal when she went back to her room. No woman required morphine during or after locoregional anesthesia.

The two groups also were comparable for general conditions (Table 2). The SSC newborns, in the time between their arrival from the operating room and the mothers' return to the room, had a slightly smaller but not statistically significant drop in temperature ($M = 0.2$, $SD = 0.6$) than the controls ($M = 0.4$, $SD = 0.5$).

In both groups, 13 newborns were held by their fathers and 3 were put under a radiant warmer; 1 SSC was put in the crib, and for 1 in the routine group, the information was missing. Mean time between delivery and bathing was 23 ± 15 min for the SSC group and 20 ± 7 min for controls. Mean time from delivery to the mother's return to her room was 51 ± 10 min in both groups. Only 1 of the 17 women assigned to SSC refused it. After the first 30 min, 12 women were sustaining SSC; and 10 women, after 60, 90, and 120 min. Mean duration of SSC was 82.9 ± 45.9 min (range, 32–215 min).

Temperature

There were no differences in newborns' mean temperatures at each interval. When the babies were held by the father before the mother's arrival, the mean temperature drop was from 36.0°C to 35.0°C for SSCs and from 36.3°C to 35.9°C for controls. Except for three SSC newborns and two controls, the temperatures of the babies and the mothers rose (Table 3).

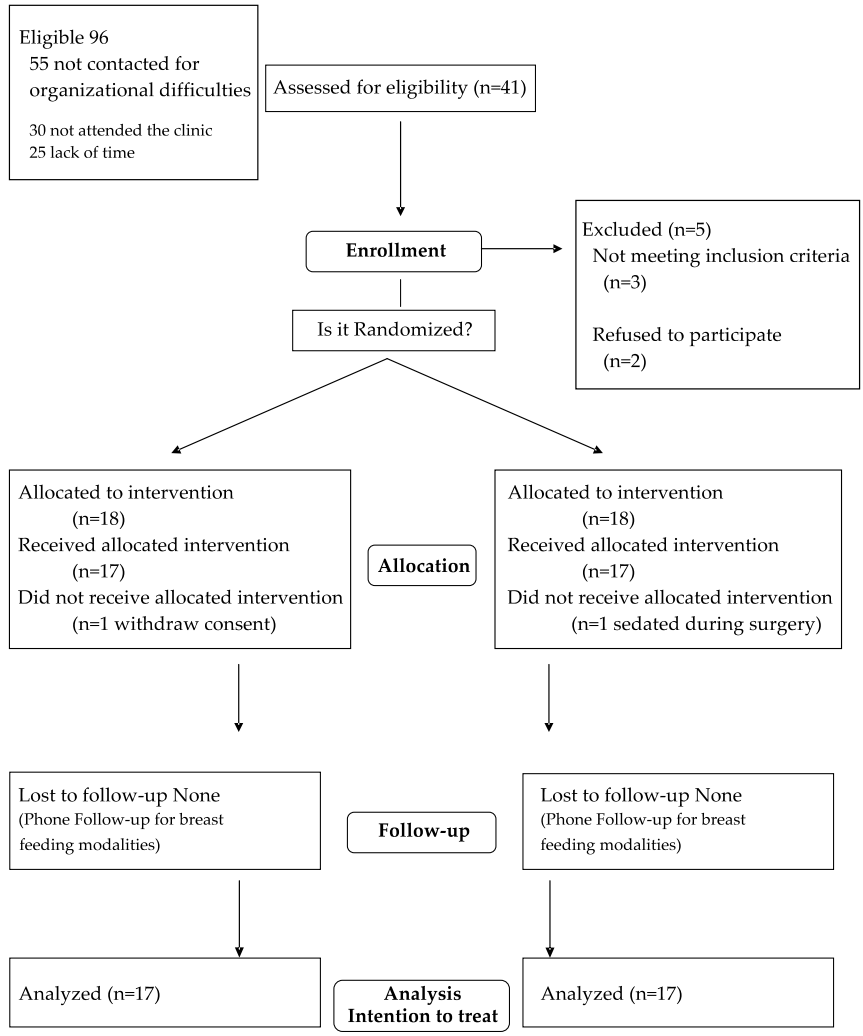

FIGURE 1. Flow of participants.

The reduction in temperature after 120 min was 0.2°C, 0.2°C, and 0.1°C in the three SSC newborns and 0.5°C and 0.3°C in the two controls.

First Attachment to the Breast and Breast-Feeding at Discharge

The average time that elapsed from the mother's return before the baby was attached to the breast was 22 ± 8 min in the SSC group and 43 ± 67 min in the controls. The first suckling was effective in both groups (IBAT mean scores: 9.2 ± 3.8 for SSC and 8.2 ± 3.2 for controls).

During the first half hour, nine SSC newborns and four controls were breast-fed. Seven SSC newborns and two controls were breast-fed for at least 1 hr during the first 2 hr. Five SSC newborns and seven controls did not start breast-feeding.

More controls than SSC newborns were held by relatives (one SSC and five controls at 60 min; two SSCs and eight controls after 120 min). After 90 min, one SSC infant was put under a radiant warmer (the newborn's temperature was 36.6°C, but the mother's temperature was low, 35.3°C, and she was feeling cold); one control was put under a warmer after 120 min at the mother's request (the baby's temperature was 36.4°C, the mother's was 36.6°C).

At discharge, 13 SSC (9 exclusive, 4 prevalent) newborns and 11 (9 exclusive, 2 prevalent) controls were breast-fed. When contacted by telephone after 3 months, 11 SSC (8 exclusive, 3 prevalent) women and 8 (5 exclusive, 3 prevalent) controls were breast-feeding: SSC, 63 ± 38.8 days, and controls, 48 ± 34.9 days.

Satisfaction

Twelve SSC women (5 did not complete the questionnaire) were very satisfied and convinced that SSC contributed to the feeling of closeness to the child (very much/completely); 10 stated that it improved the relationship with the child (very much/completely). Only 1 father felt excluded, but this feeling was not shared by the others (9 couples answered not at all, 2 just a little).

None of the women experienced uneasiness with SSC; seven were convinced that it significantly improved breast-feeding (very much/completely). Only two did not perceive any benefit. Eleven women would suggest SSC to a friend and eight would continue it at home. The mothers confirmed that the experience elicited positive feelings such as love, tenderness,

TABLE 1. Main Characteristics of Mothers and Newborns

	Skin to Skin (*n* = 17)		Controls (*n* = 17)	
	n	%	*n*	%
Mothers				
Age, *M* (*SD*), years	35 (5)		33 (5)	
Gestation, *M* (*SD*), weeks	38.6 (0.5)		38.6 (0.5)	
Education				
Elementary school	7	41	5	29
High school	5	29	8	47
University degree	5	29	4	29
Primigravidae	2	12	6	35
Previous breastfeeding	11	69	9	82
Complications during delivery	0		1	
Ice bag at arrival from operating room	15		14	
Newborns				
Males	8		10	
Birthweight, *M* (*SD*), g	3,409 (390)		3,305 (290)	
1-min Apgar score, *M* (*SD*)	9 (0.3)		9.3 (0.6)	
5-min Apgar score, *M* (*SD*)	10 (0)		9.9 (0.3)	

Note. Differences not statistically significant.

and touch and limited the feeling of "tearing (stretching/ripping)" that some associated with cesarean delivery.

Discussion

The results support the use of SSC in cesarean deliveries and indicate that it was not associated with a drop in temperature. This study extends to cesarean births the findings of previous studies on newborns' skin temperature during SSC. The smaller temperature drop in the SSC newborns than in controls before the mother's arrival may be due to the cap worn by SSC newborns that prevented heat dispersion (McCall et al., 2008). After the mother's arrival, no differences were observed between

TABLE 2. Temperatures (°C) of Mothers, Newborns, and Rooms

	Skin to Skin (*n* = 17)		Controls (*n* = 17)	
	M	*SD*	*M*	*SD*
Mothers' temperature				
Before surgery	36.6	0.5	36.6	0.5
After surgery	36.5	0.6	36.5	0.6
When holding the baby	35.2	0.4	35.5	0.4
Newborns' temperature				
On arrival from operating room	36.0	0.5	36.3	0.2
After bathing	35.9	0.7	36.2	1.4
When given to the mother to hold	35.9	0.4	35.9	0.4
Room temperature				
Operating room	22.0	0.9	21.8	1.0
Room where the newborn was bathed	25.7	1.6	26.4	1.4
Mother's room	23.7	1.8	24.8	2.2

Note. Differences not statistically significant.

TABLE 3. Temperatures (°C) at Different Intervals

	Skin to Skin				Controls			
	Newborns		Mothers		Newborns		Mothers	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Mothers' arrival from operating room	35.9	0.4	35.2	0.4	35.9	0.4	35.5	0.5
After 30 min	36.1	0.5	35.4	0.4	36.1	0.4	35.8	0.5
After 60 min	36.2	0.4	35.6	0.4	36.3	0.5	35.9	0.6
After 90 min	36.1	0.4	35.8	0.4	36.3	0.6	36.3	0.6
After 120 min	36.2	0.3	36	0.4	36.4	0.7	36.3	0.6

Note. Differences not statistically significant.

groups. Some differences in data collection mean that results cannot be compared with those in other studies. As noted by Carfoot et al. (2003), in other studies (Christensson et al., 1992), controls were separated from their mothers and kept in an incubator or in the nursery, whereas in this study, rooming-in was offered, and in both groups, a nurse helped with breast-feeding. Therefore, it is harder to find differences.

Techniques for recording temperatures were also different: axillary, intrascapular, and foot temperature, recorded with three electronic digital thermometers every 5 min after delivery (Christensson et al., 1992, 1993), or axillary temperature 5–14 and 90 min after delivery with a digital thermometer (Christensson et al., 1993), before SSC, and immediately and 2 hr after (Bohnhorst et al., 2001), with continuous recording (Fransson et al., 2005). In this study, temporal arterial temperature was taken with an infrared thermometer on the forehead, to reduce interference in the mother–child relationship.

Unlike in other studies, where SSC newborns showed better performance than did controls (8.7 ± 2.1 vs. 6.3 ± 2.6; $p < .02$; Moore & Anderson, 2007), in the current study, both groups suckled well. The lack of difference might be due to the close monitoring in both groups (every half hour, the temperature was taken and breast-feeding advice was provided if needed). Results observed are better than those observed in routine care; in fact, most newborns (70.6%) in the current study center, whether delivered vaginally or by cesarean section, are breast-fed within 2 hr while the percentage rose to 88.2% in both study groups. In this study, only two newborns in each group were not breast-fed within 2 hr. The SSC vaginally delivered newborns started breast-feeding sooner than the controls, as reported in other studies (Moore & Anderson, 2007). At discharge, 13 (76%) SSC babies and 11 (64.7%) controls were being breast-fed exclusively (in routine care overall, 66.6% of newborns by vaginal and cesarean deliveries are breast-fed), and the number was still higher in the SSC group 1, 2, and 3 months after delivery. This is supported by a systematic review (Anderson et al., 2007; Moore et al., 2007) on vaginally delivered newborns confirming the effectiveness of SSC on breast-feeding at 1–4 months (odds ratio = 1.82, 95% confidence interval = 1.08 to 3.07; Moore et al., 2007). These results are not confirmed in other studies (Moore & Anderson, 2007) on account of the small population.

This study confirms the feasibility of SSC after cesarean deliveries both from the organizational and the mothers' perspective. This study was organized in a public hospital on a volunteer basis and did not require extra personnel or an increase in resources, showing that the inclusion of SSC after a cesarean section can be easily adopted. The mothers' level of satisfaction was very high (the mothers who did not answer the questionnaire did practice SSC for at least 1 hr). The mean duration of SSC was 1 hr and 39 min, as in the study by Moore and Anderson (2007).

A limitation of the study is that operating rooms are not usually close to the obstetrics department, so SSC is not always possible immediately after delivery. This was the case in this study, so that, on average, 51 min had elapsed before the mothers were back in their rooms, and metabolic adaptation of the newborn may have occurred already (Christensson et al., 1992). Another limitation is the fact that the IBAT questionnaire is not validated in Italian. The results of this study can be extended to women exposed to locoregional but not to general anesthesia.

It is not possible to say whether SSC performed immediately after the delivery is equally safe, neither if it is feasible from the organizational point of view. Further multicenter studies would be required, which would also account for the variability in delivery and ward practices.

Conclusions

Cesarean-delivered newborns exposed to SSC within 1 hr from delivery are not at risk for hypothermia. The results show the feasibility of SSC (still not practiced widely in Italy after cesarean deliveries). The WHO recommendations highlight the importance of helping mothers start early breast-feeding after delivery, because early SSC was related to suckling immediately after delivery, even for cesarean deliveries (WHO, 1998). The results of this study show that SSC can be performed safely in cesarean deliveries because it does not increase the risk of hypothermia. ▼

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