Sensorial Saturation for Neonatal Analgesia

Carlo V. Bellieni, MD, Duccio M. Cordelli, MD, Simonetta Marchi, Simona Ceccarelli, Serafina Perrone, MD, Marianna Maffei, MD, and Giuseppe Buonocore, MD

Aim: Sensorial saturation (SS) is a procedure in which touch, massage, taste, voice, smell, and sight compete with pain, producing almost complete analgesia during heel prick in neonates. SS is an apparently complex maneuvre, but when correctly explained it is easily learnt. In the present paper, we studied its feasibility, assessing whether a long training is really needed to achieve good results.

Materials and Methods: We enrolled 66 consecutive babies and divided them randomly into 3 groups which received the following forms of analgesia: glucose plus sucking (A), SS performed by nurses (B), SS performed by mothers (C). We did not use perfume on the caregivers' hands, so that babies could smell the natural scent of the hands. We assessed pain level by the ABC scale.

Results: Median scores of groups A, B, and C were: 1 (0 to 6), 0 (0 to 4), and 0 (0 to 6), respectively. Mean scores were: 0.6, 0.6, and 1.7 and standard errors were 0.38, 0.22, and 0.32, respectively. Scores of groups B and C were significantly lower than that of A ($P = 0.03$ and 0.006, respectively). No significant difference was found between values of scores of groups B and C.

Conclusions: Even without the use of perfume on the hands, SS was effective as an analgesic maneuvre. It made no difference whether SS was performed by mothers who applied it for the first time or experienced nurses. SS is rapid to learn and any caregiver (mother, pediatrician or nurse) can effectively use it.

Key Words: sensorial saturation, pain, newborn, mothers, analgesia

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Commonly used definitions of pain emphasize its personal, sensory, emotional, and contextual nature, and to some extent depend on an individual's ability to express what he or she feels when in pain.[1] Being preverbal, this approach puts newborns at a disadvantage, so that they "rarely get the attention they need."[2] Until a few years ago, it was claimed that the word pain was inappropriate for newborns, as pain is a subjective experience that newborns, because of their age, cannot have.[3] Until the 1980s, analgesics were rarely administered to newborns even in the case of surgery.[4] Now, we know that anesthesia reduces brain damage due to hypoxemia, hypertension, tachycardia, variations in heart rate, and increased intracranial pressure,[5,6] all of which are particularly dangerous because of immature cerebral vasoregulation in the premature babies.[7] The number of painful stimuli needs to be kept to a minimum, and every effort should be made to render them less painful. Guidelines for neonatal analgesia have been suggested,[8–12] especially for the most routine type of pain, blood sampling, which is usually performed by heel prick. To avoid the drawbacks of general and local analgesics,[13–18] types of nonpharmacologic analgesia have been proposed, including non-nutritional sucking and instillation of glucose or other sweet liquids on the newborn's tongue.[19]

We recently developed a nonpharmacologic system to produce analgesia in newborns during minor invasive procedures.[20–23] We called it sensorial saturation (SS), because it is based on competition of various gentle stimuli, given during the painful event, with pain transmission to the central nervous system. These stimuli (tactile, auditory, olfactory, and visual) increase the analgesic effect of oral sugar. They are analgesic in preterm[20] and term babies.[21] Intracranial pressure in preterm babies during a routine heel prick increases much less with than without SS.[22] SS is an effective analgesic procedure that adds the analgesic power of massage, scent, voice, sight, and touch to that of oral sugar and sucking. It has been considered and already included among the guidelines for analgesia in many countries.[24–30]

SS is an apparently complex procedure, but when correctly explained it is easily learnt. The aim of this study was to ascertain the feasibility of SS, by studying differences in its effectiveness when performed by experienced nurses or by mothers using it for the first time.

MATERIALS AND METHODS

This study was performed in the nursery of our hospital, with approval of the Ethical Board of Siena University. We studied 66 healthy term babies, with the written consent of their parents. Babies were enrolled consecutively in the study and were divided randomly into 3 groups according to the type of analgesia used: glucose plus sucking (group A); SS performed by the mother (group B); SS performed by a nurse (group C).

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From the Department of Pediatrics, Obstetrics and Reproductive Medicine, University of Siena, Italy.
Reprints: Carlo V. Bellieni, MD, Department of Pediatrics, University of Siena, Viale M. Bracci, Sienna, Italy 53100 (e-mail: bellieni@iol.it).

TABLE 1. ABC Scale

Item	Score
High pitch of first cry	
No	0
Yes	2
Rhythmicity	
No	0
Yes	2
Constant in time	
No (brief moan only)	0
Not (no cry, but more than brief moan)	1
Yes	2

The sum of the scores of the 3 items gives the final pain score. Acuteness is the pitch of the first cry emitted after the beginning of the heel prick. A value of 2 is assigned if the pitch exceeds 400 Hz. Burst rhythmicity means the presence or absence of rhythmic emission of cry bouts during the observation period. When pain is high, 1-s cry bouts are emitted rhythmically, separated by 0.5s pauses. Constancy expresses how constant the intensity of crying is during the observation period, irrespective of its loudness or pitch.

In group A, heel prick was performed 30 seconds after giving the baby 1 mL 30% oral glucose solution and allowing him or her to suck a pacifier during the preparatory period and throughout the procedure. Groups B and C differed in that SS was performed by a nurse or by the mother.

The nurse who performed the heel prick and scored pain was instructed in the following procedure protocol: time 0, the baby is gently placed on the sampling bed, his or her foot is exposed and held in the nurse's hand for a minute to warm it. Only babies in Prechtl behavioral state 3 at minute 1 were included: according with Precthl's classification, 5 distinct behavioral states are recognized in the neonate: 1, quiet sleep; 2, active sleep; 3, quiet awake; 4, active awake; 5, crying.[31] Minute 1: in group A, oral glucose and pacifier were given to the baby; in groups B and C, SS was started (by the mother or a second nurse, respectively). Minute 1.5, the heel was disinfected with chlorhexidine and the prick was performed.

The nurse who performed the SS was an experienced nurse, familiar with the theory and the practical use of SS. Mothers were instructed in a brief 2-minute talk about how to perform SS. During the procedure, the nurse who performed the heel prick assessed pain using the ABC scale.

ABC Scale[32]

This scale was developed and validated for term babies, and is based on acoustic assessment of cry features (Table 1), namely: first cry pitch, constancy of crying, and rhythmicity of crying. These features have been found to be correlated with pain intensity.

SS

The procedure consisted in: (1) attracting the baby's sight speaking and massaging the infant's face or back and (2) instilling 33% glucose on the infant's tongue with the timing and method described in C.

Analysis

Statistical analysis was performed with GBStat v 6.5 PC software, using multiple *t* test comparisons with Bonferroni adjustment and Kruskal-Wallis analysis of variance for comparison of median ABC scores between groups.

RESULTS

The characteristics of our groups are reported in Table 2. Median scores were: 1 (0 to 6), 0 (0 to 4), and 0 (0 to 6), respectively. Mean scores were: 0.6, 0.6, and 1.7 and standard errors were: 0.38, 0.22, and 0.32, respectively. Scores of groups B and C were significantly lower than that of A ($P = 0.03$ and 0.006, respectively). No significant difference was found between scores of groups B and C (Fig. 1).

DISCUSSION

The results show that SS was effective whether performed by mothers or nurses. This means that a long training period is not necessary to successfully perform it. This is important, because it shows the feasibility of SS.

We did not use a control group without analgesia, because our aim was not to assess the effectiveness of the technique of SS, which had already been performed,[20,21] but possible differences when it is performed with or without training. To this purpose, the use of sucking plus glucose as reference group was sufficient.

With regard to the use of perfume, SS was effectively achieved without it. Pain levels thus obtained were significantly lower than in the glucose plus sucking group and were close to zero. In previous studies, we used perfumed bath oil on the nurses' hands to stimulate olfaction during heel prick. In this study, we avoided the

TABLE 2. Characteristics of the 3 Groups of Babies Enrolled in the Study

Groups	Mean Gestational Age	Sex (M/F)	Mean Birth Weight	No. Babies	Mean Pain Score	Standard Error of Mean	Median Pain Score
A	38.1 ± 1.5	10/12	3425 ± 539	22	1.7	0.38	1
B	38.3 ± 0.9	8/14	3386 ± 544	22	0.6*	0.21	0
C	39.2 ± 1.2	10/12	3530 ± 550	22	0.6*	0.32	0

*Statistically lower than control group.
A indicates control groups, where analgesia was obtained only with oral sugar and sucking; B, SS performed by nurses; C, SS performed by mothers.

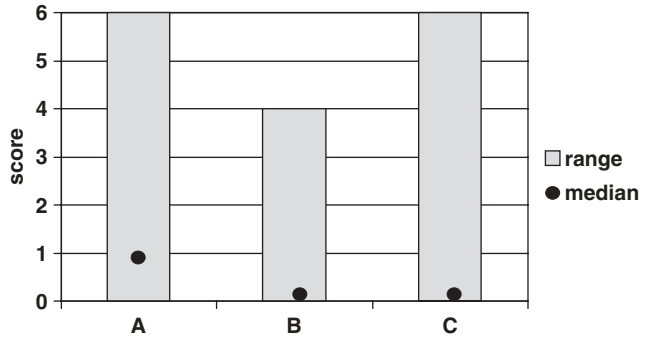

FIGURE 1. Median and range values of the 3 study groups (see text).

use of any perfumed substance, because it was criticized as unnecessarily complicating the procedure, and some colleagues reported that multisensory stimulation was effective even without any specific olfactory stimulus.

These observations show that, even in a modified form, SS effectively reduces pain during heel prick. The effect is due to competition of various stimuli with pain to reach the brain. According to the gate control theory,[33] the brain acts as a filter, not allowing all signals to reach consciousness, but amplifying some and reducing others. This is why a tactile stimulus (eg, disinfecting the place where an injection is to be performed) competes with and reduces pain: the tactile stimulus activates myelinated *A* fibers that activate interneurons in the spinal chord, arresting the painful stimulus carried by slow nonmyelinated *c* fibers.

Our results do not mean that the olfactory stimulus is unnecessary. Each woman or caregiver has her or his own particular smell, which may contribute to SS.

In conclusion, a baby who is undergoing a painful procedure requires analgesia, but also a human presence to reassure, calm, distract, and comfort.[34] SS accomplishes this aim because it can be easily performed with the active collaboration of any mother.

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