Acta Pædiatr 84: 140–5. 1995

Effects of maternal pethidine on infants' developing breast feeding behaviour

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Nissen E, Lilja G, Matthiesen A-S, Ransjö-Arvidsson A-B, Uvnäs-Moberg K, Widström A-M. Effects of maternal pethidine on infants' developing breast feeding behaviour. Acta Pædiatr 1995;84:140–5. Stockholm. ISSN 0803–5253

The aim of this quasi-experimental study was to examine the effects of maternal pethidine during labour on the developing breast feeding behaviour in infants in the first 2 h after birth compared with infants not exposed to pethidine. Forty-four healthy infants were observed immediately after birth. They were placed skin-to-skin on their mothers' chests. The development of mouth and sucking movements as well as rooting behaviour and state of sleep/wakefulness were noted. The observer was blind as to the pain relief the mother had received during labour. Of the 44 mothers 18 had received pethidine. The main findings were that infants exposed to pethidine had delayed and depressed sucking and rooting behaviour. In addition, a smaller proportion of infants exposed to pethidine started to suckle the breast. Rooting movements which are expected to be vigorous at 30 min after birth were affected both by administration of pethidine and a longer second stage of labour. It is suggested that the differences found in sucking behaviour may be a central effect of pethidine. Depression of rooting movements in the pethidine group may be caused by exhaustion due to a longer second stage of labour and administration of pethidine. It is recommended that pethidine-exposed mother–infant couples stay together after birth long enough to enable the infant to make the choice to attach or not to attach to the nipple without the forceful helping hand of the health staff. □ *Behaviour, breast feeding, infant, labour, newborn, pethidine*

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The immediate closeness between mother and child has proved to be important for bonding (1–7) and breast feeding performance in humans (8, 9). The newborn human infant uses a specific sequential behaviour in reaching its mother's nipple and starting to suckle. This behaviour has been observed when the infant is placed skin-to-skin. The infant clenches its fist, puts its hand to its mouth and starts to shape its mouth into sucking movements. At the same time rooting behaviour is increasing to a climax when the infant reaches the breast and starts its first feed (10). The search for suckling is well known in mammals (11, 12). Suckling is essential for the survival of the offspring.

Certain delivery room routines such as bathing and dressing the infant indirectly disturb the sequential behaviour in newborn infants described above. Another common ward routine in Sweden has been to give 100 mg of pethidine hydrochloride (ACO Pharmacia) for pain relief during labour. At the time of data collection for this study, 47% of all labouring women received pethidine at the study hospital and the corresponding figure for Sweden as a whole was 42% (13). At the hospital where the study took place, pethidine was the first-choice medication, administrated by the midwife according to her own judgment. Pethidine administration during labour has certain adverse effects on the infant's neonatal behaviour, including respiratory depression (14–20), reduced self-quieting activity and reduced ability to orientate towards visual and audiological stimuli (16, 18, 21). Suckling has been shown to be delayed in infants exposed to pethidine in utero (22–24). The antidote naloxone counteracts certain negative effects of infant behaviour, but only for about 2 h after a standard dose due to the short half-life of naloxone compared with pethidine (22, 23).

The aim of this quasi-experimental study was to examine the effects of maternal pethidine during labour on the developing breast feeding behaviour in infants in the first 2 h after birth. This is discussed in relation to infants whose mothers did not receive pethidine during labour.

Patients and methods

The study included 44 healthy primi- and multiparae with normal pregnancies and deliveries and their healthy full-term infants (gestational age 38–42 weeks) with Apgar scores of 7 or more 1 min postpartum. Background data are presented in Table 1. The dose of

Table 1. Background data (median (interquartile distances) or frequencies).

	No pethidine ($n = 26$)	Pethidine ($n = 18$)	p
Primiparae	6	14	< 0.001
Multiparae	20	4	
Age (years)	29 (25–31)	30 (24–32)	ns
Obstetric data			
Epidural anaesthesia	3	6	ns
Pudendal block	10	11	ns
First stage of labour (h)	8 (5–10.7)	9.3 (8–15.3)	0.04
(range)	2.5–21.3	4.8–31	
Second stage of labour (h)	0.25 (0.2–0.3)	0.43 (0.3–0.6)	0.01
(range)	0.1–1.1	0.1–1.3	
Infant data			
Apgar score at 1 min	9 (9–9)	9 (9–9)	ns
Apgar score at 5 min	10 (10–10)	10 (10–10)	ns
Birth weight (g)	3590 (3210–3900)	3400 (3180–3610)	ns
Infant sex by parity			
Boys (primiparae)	3	5	ns
Girls (primiparae)	3	9	
Boys (multiparae)	7	2	ns
Girls (multiparae)	13	2	

pethidine administered was 100 mg im to all mothers except two; one received 75 mg and another 100 mg of pethidine and a bolus dose of 75 mg.

Selection procedure and drop-outs

The mother–infant couples were selected according to the following procedure: at 08:00 the investigator, blind to the type of pain relief the mother had received, informed all women in labour at the delivery unit who fulfilled the above inclusion criteria about the study. The mother was informed that we were interested in the spontaneous behaviour of her infant. She was therefore asked not to lift the infant towards her nipple.

The first infant born each day was included in the study. Immediately after birth the infants were dried, covered with a warm blanket and put skin-to-skin on their mothers' chests, with their eyebrows at the level of their mothers' nipples.

Two women were not willing to participate and withdrew immediately after the information was given to them, i.e. before giving birth. The other women gave their informed consent. The study was approved by the local ethics committee.

Observation technique

During the first 2 h postpartum two types of observation techniques were used by an experienced observer (GL). The observation method was tested by simultaneous observations by two experienced examiners (GL and a qualified Brazelton Neonatal Behavioural Assessment Scale observer) until full concordance of the evaluation measures was reached. The observations performed are described below.

"Continuous" observation. The following behavioural items were noted in order as they first occurred: clenched fist, hand-to-mouth movement, first rooting (directed turning of head towards a stimulus; touch of mother's skin or nipple or the infant's own hand with concomitant opening of the mouth) (25); first lip movement (any type of lip movement not involving mouth opening); mouth movement (movements involving mouth opening); sucking movement (shaping the lips and mouth to a suck, sometimes followed by smacking sounds); and attaching to the nipple and starting to suckle the nipple.

"Intensive" observation. The intensive observation started at birth, and continued for up to 2 h, or until the infant fell asleep. It was performed for the first 5 min and at 10 min for 1 min and thereafter every 15 min for 2 min. Three variables were studied at these time points. Rooting movements were assessed according to a previously used method (10) with "none" = 0, "low" = 1 (the infant tends to turn the head without lifting it), "medium" = 2 (moves the head without turning and lifting), "high" = 3 (the infant lifts its head and turns from side to side). Sucking movements were also assessed according to a previously used method (10) with "none" = 0, "low" = 1 (the infant stretches out its tongue, shapes the mouth into single sucking movements), "medium" = 2 (regular sucking movements) and "high" = 3 (intensive sucking

Table 2. Times before first appearance of specific behaviours (median (interquartile distances)).

Age (min) at	No pethidine ($n = 26$)	Pethidine ($n = 18$)	p
1st lip movement	8.5 (7–14)	15 (12–22)	0.02
1st mouth movement	9 (7–10.8)	20 (12–22)	< 0.0001
1st clinched fist	10 (8–13)	9.5 (7–14)	ns
1st hand-to-mouth movement	13 (10–19.5)	14.5 (11–19)	ns
1st rooting movement	14.5 (10–16)	19 (12–29)	0.03
1st sucking movement	21 (14.3–27.8)	32 (21.8–75.5)	0.01
1st suckle (during observation)	69.5 (42–89)	89 (70.5–114)	0.04
No suckle (rel. frequencies)	5/26 (19.2%)	9/18 (50%)	ns (0.07)

movements, the infant sucks and make smacking sounds). State of sleep/wakefulness was studied according to the Brazelton Neonatal Behaviour Assessment Scale (BNBAS) (26), scored as follows: deep sleep = 1, light sleep = 2, drowsy = 3, alert = 4, considerable motor activity = 5, crying = 6.

Statistical methods

The material was analysed using either the Mann–Whitney *U*-test or contingency table analysis. The median was used as the central measure and interquartile distances (Q25–Q75), unless otherwise stated. Multiple regression analyses were performed to measure the impact of different background variables on infant behaviour.

Results

Behaviour in infants exposed and not exposed to pethidine

The times for the appearance of the sequential behaviours are shown in Table 2. Only two of these behaviours were not delayed in the pethidine group: the first time the infant clenched its fist and the first hand-to-mouth movement.

A significant difference between the groups in intensity of rooting was found at the 15-min observation ($p = 0.05$, Fig. 1). At 30 min rooting reached a peak in the infants not exposed to pethidine ($p = 0.001$), while the exposed infants had maximal rooting behaviour at 45 min. Rooting in the exposed group never reached the intensity of infants not exposed, as shown in Fig. 1. At 105 min the exposed infants were still rooting, whereas the unexposed infants had stopped rooting ($p = 0.05$).

The intensity of sucking movements was depressed throughout the observation period with significant differences between the groups at 15, 30, 45 and 60 min after birth, as shown in Fig. 2.

The state of sleep/wakefulness did not differ between the groups throughout the observation period (data not shown).

Most infants in both groups reached the areola themselves. Infants not exposed to pethidine started sucking the nipple earlier than the exposed infants ($p = 0.04$, Table 2).

Importance of background variables on infant behaviour

Ten dependent variables were studied by multiple regression analyses in order to explore whether the significant differences in background variables could explain differences in infant behaviour. The independent variables were the same in all analyses; first stage of labour, second stage of labour and pethidine administration (Table 3). Administration of pethidine was found to be the most important factor in explaining all but one of the behaviours of the infants. The exception was the first rooting movement, where the duration of the second stage of labour played a more important role than pethidine administration (Table 3). Intensity of rooting at 30 min was influenced both by pethidine and the duration of the second stage of labour. Sucking intensity was influenced by pethidine at 45 min and by the duration of the second stage of labour at 60 min, as shown in Table 3. To explore the impact of the second stage of labour further, regression analyses were performed in the pethidine and non-pethidine groups separately. The duration of the second

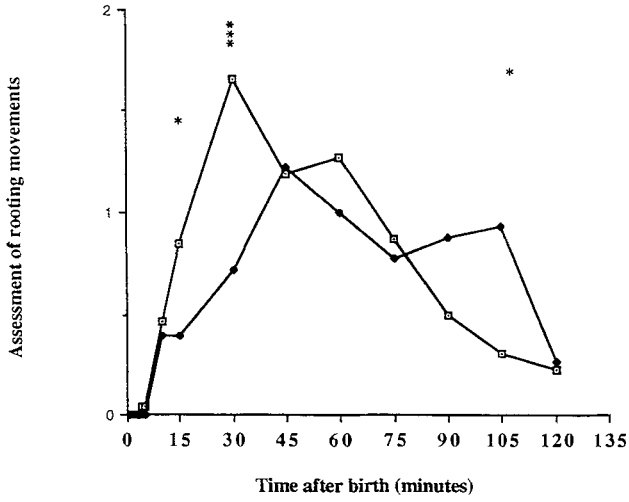

Fig. 1. Mean rooting movements in infants exposed (◆) and not exposed (□) to pethidine. *$p = 0.05$, **$p = 0.01$, ***$p = 0.001$ (For all observations the following number of children participated in each group: non-pethidine group: $n = 26$ at 15–60 min; $n = 25$ at 75 min; $n = 22$ at 90 min; $n = 20$ at 105 min; $n = 18$ at 120 min. Pethidine group; $n = 18$ at 15–75 min; $n = 17$ at 90 min; $n = 15$ at 105–120 min.)

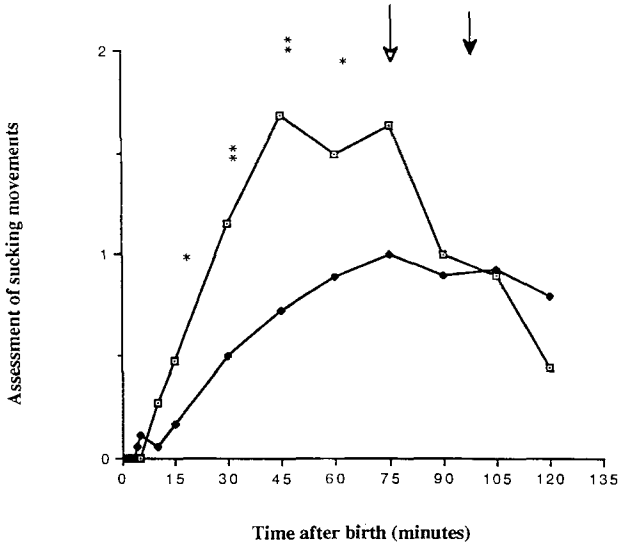

Fig. 2. Mean sucking movements in infants exposed (◆) and not exposed (□) to pethidine. The open arrow indicates median time point for start of suckling in the non-pethidine group and the filled arrow indicates median time point for start of suckling in the pethidine group $*p = 0.05$, $**p = 0.01$. (For all observations the following number of children participated in each group: non-pethidine group: $n = 26$ at 15–60 min; $n = 25$ at 75 min; $n = 22$ at 90 min: $n = 20$ at 105 min; $n = 18$ at 120 min. Pethidine group; $n = 18$ at 15–75 min; $n = 17$ at 90 min; $n = 15$ at 105–120 min.)

stage of labour did not affect rooting behaviour in the non-pethidine group, but in the pethidine group it had adverse effects on both the first rooting and the intensity of rooting at 30 min, as shown in Table 4. No significant effects of the second stage of labour were found on sucking intensity at 60 min when the groups were analysed separately (data not shown).

In order to explore the effects of other types of pain relief on the different behaviours an additional four regression analyses were conducted. The first and second stages of labour, administration of pethidine and epidural or pudendal block were chosen as independent variables, and the first sucking, lip, mouth and rooting movements were chosen as dependent variables, one in each regression. Pethidine was found to be the only variable that could explain the different time lapses between birth and all studied behaviours, except the first rooting movement. The time lapse for the first rooting movement was mainly explained by the duration of the second stage of labour (data not shown).

Discussion

We have related the developing breast feeding behaviour of infants, placed skin-to-skin on their mothers' chests, to exposure to pethidine and other variables derived from differences in background variables.

Our main findings were that developing breast feeding behaviours, such as sucking and rooting, were depressed and/or delayed in infants exposed to pethidine compared with those not exposed throughout the observation period. A smaller proportion of infants exposed to pethidine started to suckle during the observation period compared with infants not exposed. In addition, a longer second stage of labour in association with pethidine exposure appeared to depress rooting behaviour (Table 3).

The adverse effects of pethidine on sucking behaviour have been demonstrated by others (20, 24). Administration of pethidine may affect the sensitivity of the mouth area in terms of delayed lip, mouth and sucking movements and difficulty in shaping the mouth into a sucking movement, as suggested by our data (Table 2).

Differences in background variables were evaluated

Table 3. Multiple regression analysis for the behavioural differences. Only significant differences at different time points are shown ($n = 44$)

	Independent variables			
Dependent variables	1st stage of labour (p value)	2nd stage of labour (p value)	Pethidine injection (p value)	r^2
1st lip movement	0.236	0.610	0.014	0.15
1st mouth movement	0.119	0.316	< 0.001	0.37
1st sucking movement	0.216	0.452	0.004	0.28
1st rooting movement	0.613	0.0002	0.080	0.39
Intensity of rooting movements				
15 min	−0.406[a]	−0.102	−0.161	0.16
30 min	0.237	−0.015	−0.010	0.38
Intensity of sucking movements				
15 min	0.266	0.933	−0.058	0.11
30 min	0.441	0.277	−0.084	0.19
45 min	0.723	0.116	−0.010	0.28
60 min	0.370	−0.020	−0.114	0.24
Age at suckling (min)	0.729	0.094	0.328	0.18

[a] Reversed correlation.

Table 4. Multiple regression analysis. Dependent variables: first rooting and intensity of rooting at 30-min observation. Independent variable: duration of second stage of labour. Analyses were carried out for pethidine and non-pethidine groups separately. In addition, an analysis on all the mothers is presented with the grouping variable injection of pethidine as an independent variable.

	First rooting no pethidine ($n = 26$)			First rooting pethidine ($n = 18$)			First rooting all ($n = 44$)		
	Regression coefficient	Std error	p	Regression coefficient	Std error	p	Regression coefficient	Std error	p
1st stage	0.223	0.216	0.3117	−0.429	0.318	0.1972	−0.075	0.252	0.6128
2nd stage	−4.413	4.169	0.308	36.235	5.989	0.0001	19.973	4.786	0.0002
Injection of pethidine							5.475	3.05	0.0802
r^2		0.019			0.676			0.385	
	Intensity of rooting 30 min no pethidine ($n = 26$)			**Intensity of rooting 30 min pethidine ($n = 18$)**			**Intensity of rooting 30 min all ($n = 44$)**		
	Regression coefficient	Std error	p	Regression coefficient	Std error	p	Regression coefficient	Std error	p
1st stage	−0.667	0.037	0.0805	0.004	0.012	0.7669	−0.025	0.019	0.2087
2nd stage	−1.001	0.71	0.1718	−0.988	0.23	0.0006	−0.934	0.365	−0.0145
Injection of pethidine							−0.632	0.233	−0.0097
r^2		0.101			0.492			0.375	

using multiple regression; both the time of the first rooting movement and the intensity of rooting at 30 min were affected by a prolonged second stage of labour and administration of pethidine (Table 3).

The findings of this study showed that a longer second stage of labour in combination with pethidine affected rooting behaviour. The duration of the second stage of labour did not affect rooting significantly in the non-pethidine group. Rooting involves muscular strength and requires a good physical condition. Other researchers have described a lower pH in the umbilical cord and also a decrease in aortic blood flow at birth in infants exposed to pethidine compared with non-exposed infants (27, 28). We did not examine pH or aortic blood flow but only Apgar score. We therefore cannot exclude the possibility that the effects observed may have been caused by exhaustion and a moderate acidosis which was not reflected in the Apgar assessment in these infants.

The findings of this study should be interpreted with caution because of the design of the study. Further analysis needs to be done on the effects of dose-to-delivery intervals and pethidine concentrations in the infant. Our material was contaminated with other types of pain relief such as epidural and pudendal block, as well as uneven distribution of pethidine between primi- and multiparae. These facts probably accounted for the differences in duration of labour. If randomization to groups exposed or not exposed to pethidine had been performed in order to avoid the influence of potential confounding variables, such as sex of the infants and parity, the validity of this study would have improved. However, this was not done for ethical reasons. A sample of primiparae exposed to no anaesthetics other than pethidine compared with a totally unmedicated group of primiparae would probably result in other difficulties; the unmedicated group would represent a more selected group in terms of parental education, attitudes and feelings of body image. With an approach of this kind the selective nature of the sample might have affected the mother–infant interaction.

We chose to use the methodology of structured direct observation. Using this methodology only previously decided items could be recorded. In a new study, video technics would be desirable as it would be possible to discover new patterns and make a detailed analysis of mouth, lip and sucking movements as well as rooting movements. Further studies are also needed on the effects of epidural and pudendal blocks on the infants' developing breast feeding behaviour.

As administration of pethidine during labour seems to delay and depress developing breast feeding behaviour, our findings suggest that the infant needs to stay longer with its mother after birth to be given a chance to start suckling and optimize bonding. In a previous study we showed that maternal bonding is improved when the infant suckles or just touches its mother's nipple within the first hour after birth (6).

It was more common for infants exposed to pethidine not to suckle during the observation period than the non-exposed infants. We therefore believe that it would be valuable for the exposed infants to stay with their mothers to facilitate touching of the nipple during sucking attempts. This is likely to improve early bonding. Furthermore, the infant should not be forced to the breast, which might lead to adverse behaviour in breast feeding situations later on (29). The health staff should provide a patient, calm and supportive environment for the new dyad.

Acknowledgments.—This study was supported by funds from the Karolinska Institute, Stockholm College of Nursing, Swedish Medical Research Council (08892) and Barnens lyckopeng, ACO, Expressens Perinatalfond, Stiftelsen Samaritens Minnesfond, Medical Research Council (grant K91-27P-08897-03A) and first of May Flower Annual Campaign. The authors thank Professor Jan Winberg, Department of Woman and Child Health, Karolinska Institute for valuable discussions and helpful suggestions.

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Received Jan. 25, 1994. Accepted Sep. 21, 1994