

Temperament and Sleep Characteristics in Two-Month-Old Infants

Igor A. Kelmanson, M.D., Ph.D.

The study aimed at assessing possible relationship between behaviour features during sleep and temperament covered period from 2001 to 2002 and comprised 115 randomly selected, apparently healthy infants from the community setting, aged two months who were singletons born at term with normal weight (>2500 g). Early Infancy Temperament Questionnaire was used to describe different aspects of infant temperament: activity, rhythmicity, approach, adaptability, intensity, mood, persistence, distractibility and threshold. Infant behavioural features during sleep were estimated using modified Children's Sleep Habits Questionnaire. The infants with more negative mood more often required rocking or rhythmic movements to fall asleep, resisted sleeping alone, slept too little, were restless and moved a lot during sleep, woke up during night screaming, sweating and being inconsolable; less often could return to sleep after waking without parental interference. Infants with higher intensity less often fell asleep alone. More active infants less often slept about the same amount each day. Less distractible babies were less often ready to go to bed at bedtime, more frequently resisted going to bed at bedtime, were reluctant to sleep alone, slept too little and less often slept about the same amount each day. More rhythmic infants were more often ready to go to bed at bedtime and less often resisted going to bed at bedtime; less often they slept too little, were restless and moved a lot during sleep, woke up very early in the morning. **(Sleep and Hypnosis 2004;6(2):67-73)**

Key words: behavior, CSHQ, EITQ, infants, sleep, sudden infant death syndrome, temperament

INTRODUCTION

Much interest has been raised in potential interactions between infant temperament and his/her behavioural characteristics during sleep. Although during wakefulness, temperament characteristics become more sharply focused and measurable, it has been

argued that there is no true independence between these two state-specific behaviours (1,2). This may seem particularly true for the very young infants in whom neurological states called "sleep" and "wakefulness" are relatively indifferent (3). Problem sleeplessness in the infants and children may result from behavioral abnormalities (4), and although some authors doubted whether temperament characteristics might be helpful to discriminate between good and poor sleeping infants (5), specific infant behavioral styles were implicated to certain sleep disturbances (1). However, it is largely

Address reprint requests to: Professor I.A.Kelmanson,
St. Petersburg State Paediatric Medical Academy, Litovskaya 2, 194 100,
St. Petersburg, Russia
Tel/Fax: +7-(812)-535-28-50
e-mail: iakelmanson@hotmail.com

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unknown whether and in what direction each domain of infant temperament may be associated with certain behavioral characteristics during sleep. Meanwhile, this is a major issue, particularly in relation to the sudden infant death syndrome (SIDS), a phenomenon involving sleep-related physiological impairments (6-9) that may influence infant behavior (10-12). SIDS babies were characterized by certain behavioral features (13-15), and infant behavior may be modified by such child-rearing practices related to the risk of SIDS as environmental organization (16), infant-parent(s) bed sharing (17), use of a pacifier in sleep (18), infant sleep position (19).

To address the issue, this study aimed at assessing possible relationship between behavior features during sleep and temperament characteristics in 2-month-old infants, age known for the peak incidence of SIDS (20).

SUBJECTS AND METHODS

The study covered period from 2001 to 2002 and comprised 115 randomly selected, apparently healthy infants from the community setting, aged two months who were singletons born at term with normal weight (>2500 g); they were born in St. Petersburg within the period in consideration.

The mothers were asked to complete the questionnaires addressing infant, maternal, demographic major characteristics. All mothers of the recruited infants agreed to participate in the survey. Parental informed consent for the participation in a scientific study was obtained in each case, and the study has been approved by an institutional ethics committee. To insure reliability and to minimize recall bias, particular attention was paid to thorough analysis of preexisting medical records which served as the only source of information about such particular variables as infant's birth weight, length of gestation, Apgar score at birth.

To objectively assess behavioral peculiarities

of the infants, as a part of interview the mothers were requested to complete the Early Infancy Temperament Questionnaire (EITQ) consisting of 76 items which describe different aspects of infant behavior (21). All of the items have six possible responses: 1, almost never; 2, rarely; 3, variable, usually does not; 4, variable, usually does; 5, frequently; 6, almost always. Groups of questions were added according to scoring sheet to produce total scores to describe nine different aspects of infant temperament: activity, rhythmicity, approach, adaptability, intensity, mood, persistence, distractibility and threshold. Each of the above were scored from 1 to 6.

The mothers also completed the questionnaire addressing infant's behavioral features during sleep. This questionnaire was an adapted version of the Children's Sleep Habits Questionnaire (CSHQ) (22). It consisted of 55 questions focused on sleep habits that affect family life, with categories about current and ideal sleep schedules, background information, bedtime routines, sleep behavior, waking during the night, morning awakening, and parental reactions to baby's sleep patterns. The mothers were supposed to think about the past week in infant's life when answering the questions (if last week was unusual for a specific reason, they should have chosen the most recent typical week). Each of the questions had three optional answers: answer "usually" should have been selected if something occurred 5 or more times in a week; answer "sometimes" if it occurs 2-4 times in a week; answer "rarely" if something occurs never or 1 time during a week.

Statistical analysis was based on Kruskal-Wallis test (non-parametric ANOVA) to explore possible association between EITQ scores on certain temperament domains and infant behavioural features during sleep. The items from CSHQ served as grouping variables, while the EITQ scores as the dependent ones. The items from CSHQ that were found to be significantly associated with the EITQ scores were further adjusted for possible confounding

and/or modifying effect of certain factors. This was accomplished by means of multiple linear regression analysis, in that EITQ score served as the dependent variable, while sleep characteristic in consideration with its three-level scale was coded 0 through 2 and was entered into the model along with potential confounders in consideration as independent variables (numerical directly, and categorical first coded as a series of binary (0/1) variables comparing each category with a reference one). Approximation was based on maximum likelihood method. The significance of association between EITQ score and sleep characteristic after adjustment was judged looking at corresponding partial regression coefficient in the model (23) with the value for significance set at $P < 0.05$. StatView 5.0 statistical package was used in data analysis.

RESULTS

Table 1 is the summary of infant and maternal major characteristics.

Some infant behavioral features during sleep from the CSHQ were significantly associated with certain integral characteristics of infant temperament. An adjustment was made for the influence of the following potential confounding and/or modifying factors: gender, birth weight and weight at study, gestational age, birth order, Apgar score at first and fifth minute, lack of breast feeding at birth and at study, maternal age, maternal education other than higher, maternal marital status other than married, as well as to simultaneous influence of all the above factors. The items for which an association with infant temperament remained significant after adjustment was made for the effect of each and all of the mentioned potential confounders are presented in Table 2.

The finding were that infants with more negative mood more often required rocking or rhythmic movements to fall asleep, more often resisted sleeping alone; it was more common with them to sleep too little, to be restless and

Table 1. Infant and maternal major characteristics

Characteristic	Number (%) or mean \pm SD
Gender:	
boys	50 (44)
girls	65 (56)
Weight at time of study, g	5214 \pm 593
Birth weight, g	3405 \pm 473
Gestational age, weeks	37 \pm 1
Birth order:	
1	103 (90)
2	12 (10)
\geq 3	0 (0)
Labour induction:	
No	60 (52)
Yes	55 (48)
Mode of presentation:	
vertex	110 (96)
breach	5 (4)
Caesarean section:	
No	103 (90)
Yes	12 (10)
Apgar score at 1 minute	8 \pm 1
Apgar score at 5 minute	8 \pm 1
Respiratory distress:	
No	104 (90)
Yes	11 (10)
Initial feeding:	
Breast only	101 (88)
Breast and bottle	10 (9)
Bottle only	4 (3)
Feeding at time of study:	
Breast only	52 (45)
Breast and bottle	27 (23)
Bottle only	36 (32)
Maternal age, years	26 \pm 5
Maternal education:	
Higher	38 (33)
Incomplete higher	5 (4)
Secondary	66 (57)
Incomplete secondary	6 (6)
Marital status:	
Married	84 (73)
Cohabiting	19 (17)
Single	12 (10)

move a lot during sleep, to wake up during night screaming, sweating and being inconsolable; less often these infants could return to sleep after waking without parental interference.

Infants with higher intensity less often fell asleep alone.

More active infants less often slept about the same amount each day.

Less distractible babies were less often ready

Table 2. Associations between EITQ score and certain infant behavioral features during sleep

Behavior characteristics	Number observations (mean EITQ score ± SD)			P*
	seldom	sometimes	usually	
Mood (Higher figures reflect more negative mood)				
Infant falls asleep with rocking or rhythmic movements:	36 (2.5 ± 0.5)	35 (2.8 ± 0.6)	44 (2.9 ± 0.7)	0.0119
Infant does not want to sleep alone:	94 (2.6 ± 0.6)	12 (3.2 ± 0.5)	9 (3.4 ± 0.5)	0.0018
Infant sleeps too little:	66 (2.6 ± 0.6)	39 (2.9 ± 0.6)	10 (3.1 ± 0.8)	0.0203
Infant is restless and moves a lot during sleep:	79 (2.6 ± 0.6)	27 (3.0 ± 0.5)	9 (3.8 ± 0.5)	0.0015
Infant awakens during night screaming, sweating, and inconsolable:	96 (2.7 ± 0.6)	11 (3.3 ± 0.5)	8 (3.5 ± 0.1)	0.0006
Infant returns to sleep without help after waking:	48 (3.0 ± 0.6)	20 (2.7 ± 0.6)	47 (2.5 ± 0.6)	0.0005
Intensity (Higher figures reflect more intensive behavior)				
Infant falls asleep alone in own bed:	41 (4.1 ± 0.6)	26 (3.9 ± 0.9)	48 (3.7 ± 0.8)	0.040
Activity (Higher figures reflect more active behavior)				
Infant sleeps about the same amount each day:	5 (4.2 ± 0.2)	22 (3.7 ± 0.6)	88 (3.3 ± 0.6)	0.0074
Distractibility (Higher figures reflect less distractible behavior)				
Infant is ready to go to bed at bedtime:	9 (3.3 ± 0.6)	37 (2.7 ± 0.8)	69 (2.4 ± 0.7)	0.0139
Infant resists going to bed at bedtime:	76 (2.4 ± 0.7)	33 (2.9 ± 0.8)	6 (3.5 ± 0.6)	0.0023
Infant does not want to sleep alone:	92 (2.5 ± 0.8)	12 (2.9 ± 0.8)	11 (3.1 ± 0.5)	0.0233
Infant sleeps too little:	64 (2.3 ± 0.8)	39 (2.7 ± 0.8)	12 (3.0 ± 0.7)	0.010
Infant sleeps about the same amount each day:	5 (3.2 ± 1.1)	22 (2.9 ± 0.8)	88 (2.4 ± 0.8)	0.0258
Rhythmicity (Higher figures reflect more arrhythmic behavior)				
Infant is ready to go to bed at bedtime:	9 (3.5 ± 0.8)	37 (3.2 ± 0.5)	69 (2.9 ± 0.7)	0.0111
Infant resists going to bed at bedtime:	76 (2.9 ± 0.6)	33 (3.3 ± 0.6)	6 (3.5 ± 0.8)	0.0042
Infant sleeps too little:	64 (2.9 ± 0.7)	39 (3.4 ± 0.6)	12 (3.5 ± 0.5)	0.0139
Infant is restless and moves a lot during sleep:	81 (2.9 ± 0.7)	29 (3.3 ± 0.7)	5 (3.6 ± 0.2)	0.0132
Infant wakes up very early in the morning:	80 (2.9 ± 0.6)	18 (3.3 ± 0.7)	17 (3.4 ± 0.6)	0.0197

* Kruskal-Wallis test (non-parametric ANOVA)

to go to bed at bedtime, more frequently resisted going to bed at bedtime, more often were reluctant to sleep alone. In parental opinion, they more often slept too little and less often slept about the same amount each day.

Higher rhythmicity was a more common finding in the infants who were ready to go to bed at bedtime, less often resisted going to bed at bedtime, slept too little, were restless and moved a lot during sleep, woke up very early in the morning.

These associations remained significant after adjustment has been made for such potential confounding and/or modifying factors as infant's gender, weight at birth and at study, gestational age and age at study, Apgar score at 1 and 5 minutes, birth order, maternal age and education, maternal marital status, infant's feeding at birth and at study, as well as to simultaneous effects of all the above variables.

DISCUSSION

The study aimed at evaluation of possible relationship between integral characteristics of infant temperament and certain features of his/her behaviour in sleep. Although according to some reports, temperament does not discriminate between good and poor sleepers in otherwise healthy infants (5), the findings from this study were that the babies presented with more negative mood, higher intensity, lower distractibility and lower rhythmicity according to temperament measures had more often problems related to initiating and maintaining sleep at night. This was generally in accord with previous findings on the fact that the infants with so-called difficult temperament were characterized by frequent night waking (24) and shorter sleep duration (25,26). Likewise, the mothers regarded colicky infants as more intense in their reactions and more negative in their mood (27). Infants who required care giving during the night were rated as significantly more difficult and arrhythmic (28).

Infant behavior has been shown to be

modified by sleep disordered breathing, particularly sleep apnea (10,29). It has been further hypothesized that temperament might have been an indicator of arousability from sleep in the infants (30). Some authors suggested that the "threshold" dimension would be the most predictive characteristic of arousability because it measures the stimulus intensity required to evoke a discernible response, however failed to confirm such an association (31). In this present study, a threshold characteristics also was not significantly related with any specific feature of infant behavior in sleep.

It is difficult to determine whether disturbed sleep was caused initially by a specific temperament trait or by a parent's behavior (in response to a trait or independently) because interactive effects always evolve. Regardless of etiology, the end result of all sleep disturbance is sleep-loss stress associated with a predictable stimulating biochemical response. The sleep deficit causes chemically stimulating stress response in the infant which adversely affects mood, performance, and temperament (1).

It is unclear whether sleep-temperament interactions may persist across the time. However, some authors provided affirmative arguments. Significant correlations between sleep measures in a neonatal period and later temperament dimensions have been reported (32), and the children presented with colicky behavior during sleep in the infancy displayed more negative emotions according to the temperament scale at four years of age (33). Insufficient sleep time was also a more common finding among older children with difficult temperament (34). Behavioral sleep disturbances in children were associated with intense and negative temperament characteristics (35), and with "intermediate high to difficult" temperament profile (36).

Several caveats should be considered looking at the findings from this study. First, less positive parenting practices are more common among mothers who are younger,

have more than one child living at home, are single, have a lower income level, and have lower educational attainment. These mothers also tend to perceive their children as demonstrating more difficult behavior problems (37). Therefore, a concern may be raised as to possible confounding effects of the above demographic characteristics on the revealed associations between maternal-reported infant temperament dimensions and infant's behavioral features during sleep. Meanwhile, the associations between temperament scores and infant characteristics during sleep remained significant after adjustment had been made for each and all of the above potential confounders. Previous studies have also shown that infant's behavior and parental characteristics made independent contributions to parents' perceptions in early infancy (38). Second, both infant temperament characteristics and behavioral features in sleep were measured using maternal reports,

therefore leaving a chance for subjective estimates. Although in some cases maternal responses might have been incorrect, such misinterpretation was probably a non-differential one: it was unlikely that the mothers who responded more positively to questions about infant temperament features might have also responded positively to more favorable behavioral measures of their infants during sleep. If so, such misinterpretation could not have served as a source of information bias and could not invalidate the results. Finally, according to study design, only 2-month-old infants entered the survey, and the results relevant to that specified age group cannot be easily extended to other age strata.

With all these limitations in mind and with understanding that further studies in the field are needed, one can argue that the certain characteristics of infant temperament may be associated with specific disadvantageous infant behavioral features during sleep.

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