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Preterm discharge effects: Relationship between the maternal experience and newborn's psychobiological regulation

The purpose of this study is to investigate how the past experiences of mothers and their potentially traumatic events during pregnancy may have influenced the processes of psychobiological self-regulation and cognitive development in a child born preterm. Eighty children who had a gestational age of < 32 weeks were examined at the 9th month of the corrected age. The mothers and children were divided in two groups: multipara mothers and their children and the primipara mothers and their children. These children were examined on the basis of sleep disorders, nutritional problems and mental development. Perinatal data from clinical observations and data from standardized developmental tests (BSID, II ed.) were used to describe the differences. The children of primipara mothers who had unexpected preterm delivery presented major incidences of sleep disorders while the children of primipara mothers, who programmed preterm delivery, presented a major incidences of nutrition problems. The predictability of preterm delivery has a major influence on the capacity of newborns for self-regulation in the case of primipara mothers.

Keywords: *preterm, parity of mother, self-regulation, cognitive development*

Introduction

The maternal relationship in the early developmental stages facilitates the newborn's modulation of the biological processes: sleep-wake cycle, heart rate, respiration and digestion (Hofer, 1996). This relationship exists between mother and child in the first months of life (Lichtemberg, 1995). Children develop the ability to self-regulate their biological needs such as hunger-satiety, sleep-wake, and emotions on the basis of reciprocal regulation and the mother's capacity to recognize and respond in an empathic way to these needs (Emde, 1988; Stern, 1985). The experience of prematurity may therefore affect the psychobiological, behavioral and cognitive development of the child. A more difficult temperament has been ascribed to preterm children than to children born at term (Langkamp et al., 1998). Because of neurobehavioral organizational problems, a preterm infant may have less regular sleep-wake and nutritional cycles (Als, 1992, Hughes et al., 2002).

Sometimes, among the mothers of children born preterm (VLBW), the memory of preterm delivery continues even eight to nine months after the birth of their. This period might be accompanied by maternal depression and may inspire feelings of fear, horror, nightmares or helplessness. As a consequence women who experienced preterm delivery may develop symptoms of posttraumatic stress disorder (PTSD) (Affleck et al., 1991, Bailham, 2003, Kersting et al., 2004), especially among those who had complicated pregnancies due to preeclampsia (von Pampuset et al., 2004). The incidence of PTSD related to delivery varies from 1.5% (Ayers, Pickering, 2001) to 5.6% (Creedy, Shochet, Horsfall, 2000). In the case of preterm birth, the incidence of PTSD varies from 34% (Soet et al., 2003) to 55% (Ryding et al., 1998).

However, not every mother who experienced preterm

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delivery developed PTSD.

Mother of preterm or low birth weight infants are at risk for experiencing psychological distress and depression following the child's birth, and although these symptoms tend to decrease over time, some mothers remained depressed (Miles et al. 2001; Poehlmann et al, 2009). There are several factors that may protect these mothers. An important one is the previous experience of pregnancy, which brings about sense of being able to manage another childbirth (Della Vedova, 2006). Another factor is the predictability of preterm delivery when the mother is informed and prepared for the premature birth of her child. If the mother is aware of the potential premature birth, she is more able to imagine the reality of this possibility.

A negative influence on a mother's psychological state is an unexpected premature birth. The preterm birth, as unpredicted, is considered a potentially traumatic event. It may affect the mother's psychological condition and may have an influence on the reciprocal regulation. The children whose parents have been diagnosed with PTSD are more vulnerable to have eating and sleeping problems during the first year of life (Pierrehumbert et al., 2003). According to Stern (1995) sleep disorders during this time period may be linked to the mother's anxiety about her newborn's survival.

Therefore the quality of interactive exchanges between mother and child during the first months of life (maternal involvement, positive emotional tone, willingness to play, including social and physical contact, reciprocity and contingency in interaction) seems to be the most effective predictor of language, cognitive, and psychomotor development at the age of 9 months and cognition development at the age of 12 months (Poehlmann and Fiese, 2001).

The results from the longitudinal study shows that extremely preterm children born <26 weeks gestation age, at 11 years of age may have high risk for ADHD, the emotional disorders and cognitive impairment disorders. The mechanism of association with psychiatric disorder may include both cognitive impairment and early traumatic experiences that could have an impact on both child and parent (Johnson et al., 2010).

In this study we intend to evaluate the relationship between the mothers experiences of pregnancy and childbirth (abortion, pregnancy at risk, unexpected childbirth) and the psychobiological self-regulation (sleep and nutrition) and cognitive development of a preterm infant at the age of 9 months.

Method

Between January 2006 and January 2008, at the Hospital "Fatebenefratelli - San Giovanni Calibilta" in Rome, conducted multi-specialist follow-up of 125 preterm children at the 9 month post-menstrual age (PMA). Data were collected through medical records as part of scheduled sessions managed by psychologists. The following preterm children were excluded: twins (20), children who had neurological damage after birth (4) and children who did not participate in the Bayley Scales for Infant Development (21).

The research was conducted on 80 children (35 females and 45 males) at the GA of < 32 weeks (M = 30, SD = 2.0) and 80 mothers. Mothers and children were divided in two groups: primipara (49) and multipara (31).

Clinical data was collected during follow up meetings with a psychologist and included: mothers age, schooling, previous pregnancies, spontaneous abortions, as well as the pregnancy and delivery process.

Two categories have been identified on the basis of the experience of pregnancy and delivery: a) Expected Preterm Delivery (EPD): childbirth scheduled due to pregnancy risk (premature detachment of the placenta, growth retardation, etc.); b) Unexpected Preterm Delivery (UPD): pregnancy supposedly without problems, but which led to unexpected childbirth due to issues such as preeclampsia, syndrome HEELP and rupture of the membranes or bag, etc.).

Regarding the children, the following information was gathered: gestational age at birth (GA, weeks), birth weight (in grams) and the time of hospitalization in neonatal pathology (in days). Added to this was information on sleep disorders such as difficulty falling asleep (time greater than 30 min.) and the number of night awakenings (more than four in children at 6 months PMA) reported by the mothers. Also reported was difficulty completing meals (in children in age between 6 and 9 months PMA) and a constant aversion to food (in the absence of adverse conditions such as illness, gastro-esophageal reflux, etc.).

Bayley Scales for Infant Development (BSID II ed.; Bayley, 1993) were administered to the children at 9 months of EPM in order to obtain an Index of standardized Mental Development (MDI), M = 100 and SD = 15. The Age of Mental Development (MDA) is the level of development attained on the basis of skills acquired in relation to the evolutionary stages. This follow-up study was approved by the Committee on Bioethics of the Fatebenefratelli Hospital, Isola Tiberina in Rome.

Statistical analysis

Comparisons between the two groups of participants were examined by chi-square tests for categorical variables (or Fisher exact test when appropriate), and Student's t-test for continuous variables. The adjusted odds ratio

Table 1
T-student test, comparison between primipara and multipara mothers regards children's GA, weight, time of hospitalization, mental development and parent's age.

Children	Primiparas			Multiparas			Totale			
	N	Mean	SD	N	Mean	SD	N	Mean	SD	p
GA (week)	49	30,0	2,2	31	30,5	1,8	80	30,2	2,0	
Weight	49	1,3	0,4	31	1,5	0,4	80	1,4	0,4	
Hospitalization	49	50,1	26,5	31	40,6	18,0	80	46,4	23,9	0,037
PMA	49	8,5	0,8	31	8,5	0,7	80	8,5	0,7	
MDI	49	77,9	10,0	30	82,9	9,0	80	79,8	9,9	0,036
MDA	49	6,0	1,3	31	6,4	1,0	80	6,2	1,2	
Parents										
Mother age	49	34,4	5,3	31	36,7	4,0	80	35,3	5,0	0,042
Father age	48	36,4	4,9	31	38,9	4,8	79	37,4	5,0	0,029

Table 2
The frequencies regards mother's difficulty concerned the pregnancy and previous abortions and children's sleep and eating problems.

Mothers	Primiparas N=49		Multiparas N=31		Totale N=80	
	N	%	N	%	N	%
Pregnancy at risk	31	63,3	18	60,0	49	62,0
Hospitalization in pregnancy	19	38,7	8	25,8	27	33,7
Hospitalization post pregnancy	7	14,3	2	6,4	9	11,2
Abortions	12	24,5	6	19,4	18	22,5
Children						
Sleep disorders	12	24,5	6	19,4	18	22.5
Difficulty of eating	6	12,5	3	10,0	9	11,5

Table 3
Comparisons between primipara and multipara mothers, regards their previous abortions, sleep and eating difficulty of their child.

	Primiparas Abortions				Multiparas Abortions				p*
	no		yes		no		yes		
	n	%	n	%	n	%	n	%	
Sleep disorders	9	25,0	2	16,7	6	24,0	0	0,0	0,515
Difficulty of eating	5	13,9	1	9,1	3	12,5	0	0,0	1,000

*p value – Fisher's exact test

(aOR) with a 95% confidence interval (95% CI) was calculated for each dependent variable using the logistic regression model, considering the parity of the mother as an independent variable. A linear regression analysis was used to evaluate the influence of GE to ESM. A p value of < 0.05 was considered statistically significant. All the analyses were performed with SPSS for windows (13.0 SPSS. Inc. Chicago, IL).

Results

The 80 observed children were born with an average of 30 weeks GA (SD ± 2.0). The time of hospitalization in Neonatal Intensive Care Unit was about 46 days (SD ± 24). A longer time of hospitalization was noted in the case of children of primipara mothers than that of multipara mothers ($p = 0.037$). In regard to gestational age, there was no difference between the two groups. The mean age of mothers and fathers was 35 years (SD ± 5), and as we expected, the multipara parents' group were older than the primipara parents' group (mothers 36.7 vs 34.5; $t_{(75)} = -2.126$; $p < 0.05$).

Regarding mental development, the results demonstrate that at 8.5 months (PMA) the children in both groups show an MDA of 6 months in comparison with the children born at term. A developmental comparison between children of multipara mothers and those of primipara mothers illustrates higher MDI in the case of children of multipara mothers (82.9 vs 77.9; $t_{(76)} = 2.136$; $p = 0.036$).

With regard to spontaneous abortions, 22.5% who delivered prematurely experienced spontaneous abortions in the past, regardless of whether they were primipara and multipara.

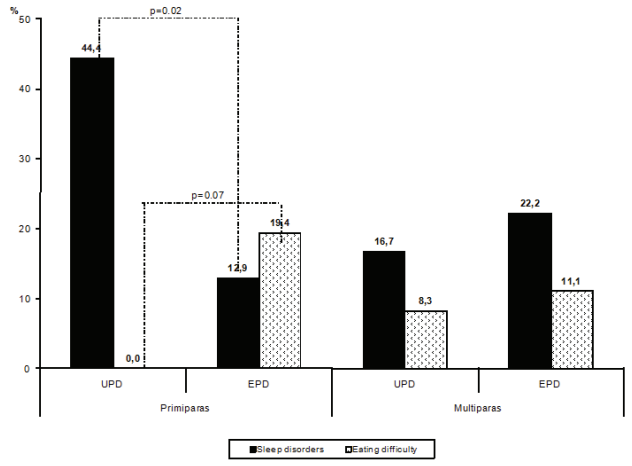

Figure 1. Comparison in two groups of mothers: primipara UPD and EPD, and multipara UPD and EPD, considering sleep disorders and eating difficulty of their child.

In consideration of child sleep disorders and nutritional problems, there is no difference between primipara and multipara mothers who had aborted spontaneously and mothers who did not abort.

Regarding the expectation of delivery in primipara mothers, the UPD is associated significantly with children's sleep disorders (UPD 44.4% vs EPD 12.9%; $X_{(1)}$=6.126 Fischer exact test: p = 0.02), whereas there was no noticeable difference in the multipara group.

A converse phenomenon is observed in the nutritional sphere. Among the 31 of primipara mothers who had an EPD, 19.4% had children with nutrition problems. None of children of the primipara women UPD ($X_{(1)}$=3.760 Fischer exact test: p = 0.07) had such problems. The same differences are found in multipara mothers but to a minor extent (EPD 11.1% vs UPD 8.3%). The results show a four time grater risk of sleep disorders in children of primipara mothers UPD compared with the children of primipara mathers EPD (95% OR 4.3 CI 1.04-17.7).

The MDI does not correlate with gestational age and birth weight, length of hospitalization and age of parents. Such results may indicate that the cognitive level attained at the age of 9 months is not determined by prematurity and biological factors related to it. No relationship was found between MDI and the instances of sleep disorder, nutrition, gender or spontaneous abortion.

The difference between PMA and MDA, shows developmental delay. The children of women who aborted had more developmental delays, than children of women who had not aborted ($t_{(78)}$ = 2.301; p = 0.02). This difference is evident especially in multipara mothers ($t_{(29)}$= 2.331; p = 0.03), while the differences between children born with EPD and UPD were not significant.

Conclusions

Our data confirm that the past experience of a mother, especially being a primipara mother, may affects the health and welfare of the preterm infant and the first birth may be perceived as a risk factor. Being multipara is one of the protective factors in the case of preterm birth. This factor may decrease excessive anxiety and activate the most appropriate strategy in facilitating the eating regulation and sleep-wake patterns of preterm infants. The difficulty of self-regulation, very common in preterm children, is most likely more difficult to manage for inexperienced mothers who might have difficulty recognizing infant needs. It 'is well known that primipara mothers ask the advise of pediatricians more frequently than multipara mothers (Hakansson, 1996).

Contrary to our expectations, the experience of previous spontaneous abortions did not appear to affect the psycho-biological regulation of a child preterm. However, it may produce a delay in the cognitive development of the child. This is true especially in the case of multipara mothers.

The experience of pregnancy and childbirth and the predictability of preterm birth can affect the psychobiological self-regulation of the child. Children born preterm (UPD) have a higher frequency of sleep problems in early life. This is probably linked to the anguish of the mother about their child's survival (Stern, 1995). Instead, a mother with high-risk pregnancy (EPD), especially if primipara, has more difficulty feeding her child . This may be due to the anxiety caused by difficulty in recognizing the signals of hunger and satiety of their child, despite the reassurances of the pediatrician.

These two explored aspects, cognitive and biological, have given us apparently contradictory results. Multipara mothers are able to manage more appropriately the sleep issues and feeding issues of their child, but after inserting the spontaneous abortion variable there seems to be a major delay in the cognitive development. Primipara mothers have more difficulty reading and recognizing the biological needs of their children but they probably dedicate more time to interaction with them. Multipara mothers may spend less time with their preterm children because of being engaged with other children.

Based on the results of this research we argue that a preterm birth, especially if it's unexpected in the life of primipara mothers, is a potentially traumatic event. The effect on child development is more serious when the prematurity is linked to complicated events (sudden birth, spontaneous abortion, etc.). In these cases the risk of negative emotional experiences on the mother (anxiety, stress, depression) is greater and therefore there is the higher probability that the child may experience difficulty in psychobiological regulation (sleep, feeding, colic, etc.).

At the clinical level therefore, it is particularly important

to provide psychological support especially to mothers who have had a preterm delivery in order to prevent possible unexpected adverse effects on the development of the preterm infant.

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