

Regular Article

Depression in the Early Postpartum Period and Attachment to Children – in Mothers of NICU Infants

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Depression in early puerperium was evaluated in terms of maternal attachment in mothers of children admitted to the neonatal intensive care unit (NICU) in comparison to a control group of mothers of full-term infants.

A survey including Zung's self-rating depression scale (ZSDS), a postpartum maternal attachment scale and items addressing the mother's feelings and peripheral conditions was conducted on mothers of children admitted to the NICU.

Among the 153 mothers who gave valid responses, positive ZSDS scores of over 40 were seen in 61.8%. In terms of the children's disorder strong depressive tendency was noted among mothers of low birth weight infants. Significant correlation was noted between the ZSDS and the 'core maternal attachment' (negative correlation) and 'anxiety regarding children' (positive correlation) subscales of postpartum maternal attachment. Path analysis revealed the father's positive reaction in learning of the pregnancy resulted in elevation of the 'core maternal attachment' score, in contrast to the control group mothers.

Key words: depression; postpartum period; maternal attachment; NICU; low birth weight infants; social support; Zung's self-rating depression scale

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INTRODUCTION

The puerperal period is a time in which women undergo particularly drastic change affecting both body and mind. Alongside rapid change in the endocrine system accompanying childbirth, they are suddenly required to adopt the additional new role of mother. Additionally, birth of the baby brings about various changes in family dynamics, starting with the relationship between husband and wife, resulting in large changes affecting life general. Such being the case, the puerperium is a period in which various psychological symptoms can appear, and has thus been considered a crucial period in terms of mental health of the mother and child. A transitional state of depression in this period appearing from around day 3 postpartum for about 2 weeks (mild insomnia, fatigue, tearfulness) is called maternity blues (Pitt, 1973). The incidence of maternity blues reported in the United States is quite high, between 50 and 80% (Okano and Nomura, 1992). This rate is considerably lower in Japan, reported at 4.5% (Tsukasaki *et al.*, 1991), 25.5% (Okano and Nomura, 1992), 15.3% (Murata *et al.*, 1998), or 24% (Yamashita *et al.*, 2000). As one socio-cultural factor contributing to the low incidence of maternity blues in Japan, Okano *et al.*(1991) point out the traditional system of '*satogaeri bunben*', or return of the mother to her parental home for the period surrounding childbirth. However, the reported effects of '*satogaeri bunben*' are not necessarily consistent (Murata *et al.*, 1998; Yamashita *et al.*, 2000), and moreover, because the definition of maternity blues or its diagnostic criteria are not necessarily clear (Tsukasaki *et al.*, 1991), questions remain regarding even the differentiation between maternity blues and postnatal depression (Yamashita *et al.*, 2000).

On the other hand, recent studies report on the large effect of the mother's depression in puerperium on mother-child interaction one to one-and-a-half years after birth (Beck, 1995; Edhborg *et al.*, 2001), as well as association with a child's maladaptation (Downey and Coyne, 1990). Furthermore, in a study following up on the children of postnatally depressed mothers until age 5, Murray *et al.* (1999) indicate that "exposure to maternal depression in the early postpartum mother may have an enduring influence on child psychological adjustment". The negative effect of postnatal depression has also been pointed out in terms of cognitive development (Cogill *et al.*, 1986; Susman, 1996), all demonstrating lasting effects of the mother's mental state in puerperium on child development in one way or another. This and the high frequency of depression reported during pregnancy and the puerperal period in recent years has accentuated the need for some form of psychiatric intervention taken on increased urgency (Beck, 1995; Susman, 1996; Field, 1998; McMalon *et al.*, 2001).

Conducting a questionnaire survey on mothers of full-term infants in the puerperal period, we have also found that that extent of maternity blues stipulates in large part the strength of maternal attachment and anxiety regarding children, further demonstrating the need for active intervention for depressive states in puerperium (Nagata *et al.*, 2000).

Incidentally, low birth-weight infants and infants with respiratory disorders (as the cardinal symptom) are admitted to the Neonatal Intensive Care Unit (NICU) immediately after birth. Hospitalization of children in this unit is mostly an unexpected event for the mother, causing great emotional disturbance, and the need for extensive physical care in the unit necessitates abrupt separation of mother and child. Although it is now believed that this experience of separation does not have lasting effect on attachment formation between mother and child, commitment or several weeks to months in the unit can readily become a negative factor in the formation of the mother-child relationship.

This study was designed to evaluate the effect of depression in the early postnatal period (from a few days to 2 weeks after birth) on maternal attachment to the child through path analysis in mothers of children admitted to the NICU, for comparison with results from mothers of full-term infants, as a step toward our final objective of determining modes of support to mothers in the perinatal period. The path analysis rests on the same hypothesis constructed in a previous study (Nagata *et al.*, 2000). The path diagram was constructed from biological factors and serial hypothesis accounting for the passage of time. Although limitations exist in using a retrospective approach, it was surmised that prenatal factors do have influence on the factors shaping the puerperal period. Additionally, perspectives in which biological factors play a large role were believed to influence the psychological factors. In other words, birth order is likely to affect the conditions of peripheral support such as the father's reaction in learning of the pregnancy and the mother's feelings before the child is born was assumed to influence the mother's mental state in puerperium and her interaction with her child. Moreover, believing the biological factors should have effect on depression in the early postpartum period, they were in turn considered to influence postpartum maternal attachment.

METHOD

Subject and Procedure

The subjects were the mothers of children admitted to the NICU (NICU mothers) of the Department of Pediatrics, Nagoya Daini Red Cross Hospital between September 1995 and January 1997. This amounted to 364 mothers of 410 infants, including 45 (44 twins and 1 triplet). Among these mothers the subjects were limited to the mothers of children admitted to the NICU within 2 days to keep the difference between infants admitted to the NICU immediately after delivery in the hospital and those transferred from other medical facilities to a minimum. Cases of readmittance and death were excluded from the study, given the large disparity in conditions from infants being admitted for the first time. This selection amounted to 267 mothers, excluding 97. The Nagoya Daini Red Cross Hospital is situated in the eastern part of Nagoya City (population: approx. 2.1 million), and functions as a central medical facility in this area. Regionally, the hospital lies in a fundamentally academic district, and the parents of the infants were primarily above middle class. The NICU, equipped with 25 beds, is a middle-scale facility of its kind in Japan. It admits low birth-weight (LBW) infants and infants with respiratory disorder as the cardinal symptom primarily from Nagoya City and all parts of Aichi Prefecture. The ratio of infants born at the hospital to transferrals from other institutions is about 50:50. At the Nagoya Daini Red Cross Hospital, a clinical psychologist and a mother-child psychotherapist (including the authors) are available basically full time as part of the resident NICU term, incorporating a psychological approach centred around counseling for the mother and family from immediately after birth (Nagoya *et al.*, 1997). All mothers of children admitted to the NICU are handed information on counseling, and along with the document, the objectives of the survey was explained, and strict protection of privacy was confirmed in writing. Questionnaires were then distributed to the mothers who gave informed consent to participating in the study. Regarding the mothers of children delivered at the Department of Obstetrics of the Nagoya Daini Red Cross Hospital, the process was accomplished by a clinical psychologist and a mother-child psychotherapist visiting the obstetrics ward 2-5 days postpartum. For mothers of children born elsewhere, the process was scheduled for the mother's first visit to the NICU, at which time the papers were handed to the subject by the attending physician or nurse. The questionnaires were collected through a collection box situated within the NICU. The control full-term infants were babies born at the Department of Obstetrics of Nagoya Daini Red Cross Hospital between Sept. 26, 1995 and the end of Sept. 1996, excluding

infants admitted to the NICU and 5 deaths. Of this group involving 537 mothers, the control group consisted of 417 mothers who gave consent. The questionnaires were distributed by pediatricians during discharge guidance given 5-10 days postpartum and retrieved through a collection box set-up in the nursing room. Details from that survey have been reported elsewhere (Nagata *et al.*, 2000).

CONSTRUCTION OF THE QUESTIONNAIRE

The Japanese language version of Zung's self-rating depression scale (ZSDS) (Zung, 1965) was employed in the questionnaire as a scale for evaluating the mother's mental condition, through capturing their state of depression in puerperium. The Japanese version of the ZSDS has been standardized by Fukuda and Kobayashi (1973), and both its reliability and validity have been established. The ZSDS is widely employed as an assessment scale for depression. Its correlation with the Hamilton rating scale for depression has been reported as being 0.81 (Shima *et al.*, 1985). Conventionally, the transient form of depression appearing from a few days to about 2 weeks postpartum has been called maternity blues, differentiating the condition from postpartum depression that appears from about 1 month postpartum. However, as stated previously, the conceptual difference between maternity blues and depression in the early postpartum period is not necessarily clear. Furthermore, there has been indication that some mothers diagnosed as maternity blues may actually be cases of postnatal depression (O'Hara *et al.*, 1991). Although our current study was conducted on mothers in the period when depression can be considered maternity blues, it is not possible to confirm that this was indeed the case, being a one-time survey. There are even those reporting that the ZSDS does not appropriately reflect maternity blues (Okano and Nomura, 1992), while others report higher ZSDS scores for a maternity blues group in comparison to a non-maternity blues group (Tsukasaki *et al.*, 1991). Given such disparity, our decision was to employ the ZSDS as a scale for evaluating maternal depression in the early postpartum period, without limiting the phenomenon to maternity blues per se.

An original postpartum maternal attachment scale was used for the evaluation of maternal attachment in the puerperium (Table 1). The scale consists of 11 items addressing 'core maternal attachment' and 8 items addressing 'anxiety regarding children'. Regarding reliability of the scale, the α coefficients for both subscales were very high at approximately 0.80, but evaluation regarding test-retest reliability have

not been performed. As for reliability, although validity of content has been evaluated independently by three specialists, neither criterion-related validity nor construct validity has been established (Nagata *et al.*, 2000). Each item was rated against a 4-point scale ranging from 'not at all', 'not really', 'most of time', to 'always'.

In addition, maternal factors, newborn's factors, feeling towards the pregnancy, and conditions of support were addressed in the questionnaire in addition to data collected from medical charts. As maternal factors, problems in the gestational period, mode of delivery, number of children born, planning of pregnancy, feelings in learning of pregnancy, history of infertility treatment, age, employment status and level of education were addressed. Newborn's factors included sex, birth weight, weeks in gestation, birth order, primary affliction, day of admittance to the NICU and length of hospitalization in days. As peripheral conditions, the father's age, education, household composition, father's reaction in learning of the pregnancy, provision of help with child-care, presence of someone to turn to for advice, presence nearby of mothers with children in the same age group, and return to the parental home during the perinatal period '*satogaeri bunben*', were addressed. 'Planning of pregnancy' called for evaluation against a 3 point scale of 'planned', 'unplanned but desired', or 'unexpected'. 'Feelings in learning of pregnancy' was evaluated against a 4 point scale of 'very happy', 'happy', 'not too happy', or 'disinterested'. The 'Father's reaction in learning of pregnancy' also called for a 4 point evaluation of 'very happy', 'happy', 'negative' or 'disinterested'. Three items, 'Provision of help with child care', 'Presence of someone to turn to for advice', and 'Presence nearby of mothers with children in the same age group' called for 2 point evaluations of 'yes' or 'no'.

RESULTS

Subject Attributes

The questionnaires were returned by 161 mothers of the NICU-admitted group of infants, which was a retrieval rate of 60.0%. Among these, valid responses amounted to 153. The retrieval rate from a control full-term infant group mothers was 79.7%, indicating a lower response rate from the NICU mothers. Detailed findings from the control group have been reported elsewhere (Nagata *et al.*, 2000). The mean date of filling out the questionnaires by the NICU mothers was 6.1 ± 4.31 days post partum (range: 1-24 days), and the mean age of the mothers was 29.9 ± 4.75 yrs (range: 19-41 yrs). These values did not differ significantly from the control group. Additionally,

mean weight of the NICU infants was 2560 ± 707.34 g (range: 612-4158 g), and the male : female ratio was 93:59, showing a somewhat higher predilection for boys. Mean duration of hospitalization was 28.0 ± 33.87 days (range: 2-260 days). The rate of those practicing the traditional Japanese custom of *'satogaeri bunben'* in comparison to those who did not was 75:86, close to equal. The ratio of delivery in the institute: delivery elsewhere was 122:31. Retrieval rates according to this place of birth were 86%: 24%. In cases of delivery outside the institute, interviews with the mother often did not take place until about 1 week postpartum leading to uncertainty in both delivery and retrieval of the questionnaires, believed to be a factor in the low rate of retrieval.

Other subject attributes are given in Table 2. Incidentally, although limited information is available on the mothers excluded from the study and those from who responses were not retrieved, the following is known. The criteria for exclusion were touched upon previously, but there were 97 mothers of children born at the hospital but admitted after 3 days (78 cases), death of the infant (8 cases), mothers of other nationalities unable to respond to the Japanese language questionnaire (5 cases), mother's death (1 case), parents unknown (abandonment) (2 cases) and infants born at other facilities and discharged before the mother's visit (3 cases). This involved 54 boys and 43 girls, admitted for respiratory disorder (2 cases), jaundice (46 cases), and 49 infants with other disorders.

On the other hand, responses were not retrieved from 106 mothers. Gender of the infants was 58 boys and 48 girls, admitted for low birth weight (49 cases), respiratory disorder (25 cases), jaundice (3 cases) and 29 cases with other disorders.

The group excluded from the study and those who did not respond together, the mean age of the mothers was 30.1 ± 4.32 yrs (range: 20-41), and mean birth weight of the infants was 2312 ± 714.31 g (range: 514-4301). One mother was single, one mother was of unknown marital status and the rest were married.

There was no significant difference in mean age, infant birth weight, ratio of disorders or the length of NICU stay between the subjects of the study, those excluded, and those who did not respond.

Evaluation of Each Scale

The mean ZSDS score was 41.9 ± 7.52 points. Comparison with the full-term control group and distributions are given in Table 3 and Figure 1. The proportion of mothers giving positive ZSDS scores of over 40 amounted to 61.3% (Cronbach's α -coefficients were 0.77 for both the NICU and control groups).

On the other hand, reliabilities for the two subscales of the postpartum maternal

attachment scale tasted in the NICU group was 0.83 for the core maternal attachment subscale, and 0.79 for the anxiety regarding children subscale indicating ample internal consistency. Mean scores for each scale and standard deviations are given in Table 3.

Although scores for 'anxiety regarding children' ($p < 0.001$) and 'core maternal attachment' ($p < 0.05$) of the 'Postpartum maternal attachment scale' were significantly higher among the NICU mothers, no significant difference was seen in the 'ZSDS' score. Additionally, scores for each item were compared by the T -test. Regarding ZSDS scores, mean scores for two items, 'I feel down-hearted and blue (No. 1)' ($t = -3.92$; $p < 0.001$), and 'I have crying spells or feel like it (No.3)' ($t = -5.49$; $p < 0.001$) were found to be significantly higher and that for the item, 'I have trouble sleeping at night (No. 4)' ($t = 3.44$; $p < 0.001$), was significantly lower among the NICU mothers. Furthermore, significantly higher scores were seen among the NICU mothers in 6 items relative to the 'core maternal attachment' subscale, 'I feel at peace when my child is close by (No. 2)' ($t = -3.12$; $p < 0.01$), 'I worry about my child in many ways when my child is not with me (No. 7)' ($t = -5.11$; $p < 0.001$), 'I am willing to do anything for my child (No. 8)' ($t = -4.00$; $p < 0.001$), 'I want to touch or hold my baby when I see him/her (No. 9)' ($t = -5.58$; $p < 0.001$), 'I feel my child is terribly precious (No. 11)' ($t = -2.70$; $p < 0.01$), and 'I miss touching or holding my baby when he/she is not with me (No. 18)' ($t = -8.30$; $p < 0.001$), and in 3 items relative to the 'anxiety regarding children' subscale, 'I worry my baby might get sick (No. 14)' ($t = -3.23$; $p < 0.001$), 'I feel there is something more I should be doing for my child (No. 15)' ($t = -2.96$; $p < 0.01$), and 'I feel holding my baby could break him/her (No. 16)' ($t = -3.35$; $p < 0.001$) (Table 4).

As other perspectives, the mother's factors such as age, and level of education, the newborn's factors such as birth weight and birth order, and peripheral conditions such as support were taken up as observed variables. Of these, 'provision of help with child-care' and presence of someone to turn to for advice' were interpreted as representing a single factor, and was therefore combined into 'support in child-rearing' in further analysis (α -coefficients for the NICU group and control group were 0.62 and 0.61, respectively).

Analysis of the Association Between the 2 Scales and the Observed Variables

The association between the 2 scales and observed variables was analysed as an exploratory measure. Analysis was performed for each of the 2 subscales comprising the 'Postpartum maternal attachment scale'. Factors for which significant correlations were obtained are given in Table 5. No association was seen with factors such as educational background, place of birth, mode of delivery or '*satogaeri bunben*'.

Additionally, the cardinal symptom for which the child was hospitalized was categorized into 4 groups of: low birth weight (LBW: birth weight <2500g, $n=63$), respiratory disorders such as transient tachypnea of the newborn ($n=33$), hyperbilirubinemia requiring phototherapy ($n=32$), and other disorders including heart disease, asphyxia, etc. ($n=20$). Using this grouping, analysis of variance was performed for evaluating the association between the disorders and scores from each scale. Results of multivariate comparison revealed both higher ZSDS and anxiety scores among mothers of LBW infants (Table 6).

Path Analysis

Normal distribution was seen for each scale, with absence of extreme values. Additionally, reliability coefficients for both scales exceeded 0.60, which is believed to indicate sufficient internal integrity within each scale. Analysis was performed extracting only those variables for which significant path coefficients were found. Figure 2 is the causal model for the NICU group, giving path coefficients which were significant in the final analysis.

In the NICU group, path analysis with 'ZSDS score' as the predictive variable, and 'anxiety regarding children', and 'core maternal attachment' as the target variables, revealed significant path coefficients for both 'anxiety regarding children' (0.30, $p<0.001$) and 'core maternal attachment' (-0.17, $p<0.01$).

Furthermore, regarding 'core maternal attachment', it was seen that lowering by 1 point (negative response) in the 'father's reaction in learning of pregnancy' (father's reaction) results in a lowering by 0.31 points in 'core maternal attachment'. And regarding 'ZSDS score', it was seen that lowering by 1 point (negative response) in 'father's reaction in learning of pregnancy' (father's reaction) results in an elevation by 0.25 points in 'ZSDS scores'. Additionally, a rise by 1 point in 'ZSDS score' was seen to incur a lowering by 0.17 points in 'core maternal attachment', including that 'ZSDS score' was casting large influence upon a mother's attachment to her child. Significant paths were found between 'anxiety regarding children' and birth order. A lowering by 1 point in 'birth order' was seen to incur rise in the mother's anxiety by 0.31 points, indicating the great significant birth order has on the mother's anxiety. Similarly, a rise by 1 point in 'ZSDS score' was found to be associated with a rise by 0.30 points in maternal anxiety.

On the other hand, excluding the effect of the 'father's reaction' on 'ZSDS score', comparable associations were noted between the factors among mothers of the full-term control group. But in addition, among the control group mothers, a significant path

was found between 'ZSDS score', and the two items, 'support in child-rearing' and 'presence nearby of mothers with children in the same age group'. In other words, the presence of support with child-rearing or mothers with children in the same age group resulted in lowering of ZSDS score among the control mothers. No such correlation was noted between ZSDS score and peripheral conditions such as 'support in child-rearing' or the 'presence nearby of mothers with children in the same age group' among the NICU mothers.

CONCLUSION

ZSDS Score

It is known that prevalence of maternity blues, seen from around day 3 postpartum to about 2 weeks is fairly high, being reported at between 50 and 80% in reports from the United States (Horowitz *et al.*, 1995). On the other hand, studies in our country have reported low incidence in comparison to the West, with Ikemoto *et al.* (1986) reporting incidence of maternity blues at 6.5%, and Okano and Nomura (1992) at 25.5%.

However, in our study, we captured the results of the ZSDS as levels of depression in the early postnatal period instead of maternity blues and conducted a comparison of the NICU group mothers with a control group of mothers. The incidence rate of ZSDS-positive scores of over 40 among our control group mothers of full-term infants was 66.8%, as previously published (Nagata *et al.*, 2000). This is considerably high in comparison to other studies, such as by Ito *et al.* (1993), similarly considering over 40 as ZSDS-positive scores in a study on depressive states in puerperium, who report an incidence of 38.7%. However, considering mothers with ZSDS scores over 60 at 1 week postpartum as cases of maternity blues, Tsukasaki *et al.* (1991) report an incidence of 8.2%. Although incidence of maternity blues was not calculated from ZSDS scores in our present study, the proportion of subjects exhibiting scores over 60 amounted to 4%. This value is in fact lower than that reported by Tsukasaki *et al.*, (1991) which appears to indicate that our current result is not particularly high in comparison to the other reports from Japan.

We observed in the present study that the ZSDS-positive (over 40) rate for mothers of NICU infants was 61.3%. Although the difference between this group and the control group was not significant, the rate was in fact lower than that among mothers of the full-term infant group. There was also no significant difference in terms of mean ZSDS score between the two groups. In other words, contrary to general expectation,

the depressive tendencies were not particularly higher among the mothers of children admitted to the NICU. Although there has been little study on the depressive tendencies of mothers with children in NICUs, Blumberg (1980) reports a significantly higher level of depression in mothers of high risk children, stating that 'risk variance accounted for 24.6% of the total variance in depression, none of the variances entered subsequently accounted for a significant increase in variance', demonstrating strong correlation between a child being high risk and the mother's depression. Our current findings turned out to be contrary to such reports. We are unable to provide any definitive interpretations to this, but the disparity could be a reflection of improvement in the mental health care being provided mothers of children admitted to the NICU. Another possibility is that the exclusion criteria may have concerned a higher proportion of mothers in the NICU group than in the control group, therefore leading to the exclusion of more depressed mothers.

Incidentally, *T*-test analysis of item scores for each 'ZSDS score' sub-scale between the mothers of full-term infants and the NICU mothers revealed that although the NICU mothers exhibited significantly high scores for items relative to depressive feelings, they also exhibited significantly low scores for items addressing insomnia. This was interpreted as reflecting the expected concern and worry towards their children in the NICU (Benfield *et al.*, 1976), while raising the possibility that the complete isolation of the mother from the child, and their reliance on the total care being provided by the nursing team may rather be contributing to their unhindered sleep during the night.

Additionally, no associations were noted this time between 'ZSDS score' and factors such as problems in the gestational period, mode of delivery, treatment for infertility, place of birth or the Japanese custom of '*satogaeri bunben*', i.e. return to the parental home for the perinatal period. Some Japanese authors regard the support provided by the '*satogaeri bunben*' as a protective factor against postnatal psychiatric disorders (Okano *et al.*, 1991). However, others (Yamashita *et al.*, 2000; Murata *et al.*, 1998) report no effect of '*satogaeri bunben*' on the onset of postnatal depression or maternity blues. Our results also indicate no significant difference of '*satogaeri bunben*' on depression in the early postpartum period, in both the NICU and control groups. It is possible that '*satogaeri bunben*' does indeed have little effect on maternity blues or postnatal depression or that whether the mothers had returned to the parental home or not had been a minor effect on the mother's mental health at the time of our survey, when most mothers were still in hospital or had just been released. However, '*satogaeri bunben*' being a unique and as yet widely practiced custom in Japan, its

significance is an aspect calling for further analysis.

On the other hand, analysis according to the infant's disorder revealed significantly higher ZSDS scores among mothers of low birth weight (LBW) infants among the NICU mothers. Higher depressive tendencies among mothers of LBW or preterm infants have been pointed out in the past. The depressive tendencies in such mothers have been reported being high in the early period postpartum, followed by dissipation in a relatively short period of time (Trause and Kramer, 1983; Brooten *et al.*, 1988; Gennaro, 1988; Logsdon *et al.*, 1997; Younger *et al.*, 1997). Logsdon *et al.* (1997) also report in inverse relationship between depression and relationship quality, support and self-esteem in mothers of preterm infants. Bergant *et al.* (1999) also cite low birth weight as a factor in early postnatal depressive mood alongside burden of childbirth and other factors. Our results this time high depressive tendencies among the mothers of LBW infants early on, at 1-2 weeks postpartum. Direct comparison with other studies are not possible, as we are not aware of other reports comparing the depressive tendencies of mothers with LBW infants to mothers of children with other disorders committed in NICUs. In addition, the number of cases dealt with per disorder in this study was too small to allow for detailed analysis according to disease. However, no significant association was noted between the extent of depressive tendency and the length of hospitalization (assumed as being highly correlated with gravity of the child's condition). The high rate of depressive tendency among mothers of LBW children in comparison to mothers with children in the NICU for other disorders may be an indication of some peculiar factor apart from gravity of the child's condition.

Postpartum Maternal Attachment

Compared to the mothers of full-term infants, the NICU mother exhibited significantly high scores for 'Anxiety regarding children' and 'Core maternal attachment'. Evaluation of the items comprising these factors revealed the NICU mothers showing high scores for items related to mother-child separation and those believed to be reflecting the condition of their children being in the NICU to a certain degree, such as 'I worry about my child in many ways when my child is not with me', and 'I miss touching or holding my baby when he/she is not with me'. Moreover, in terms of the infant's affliction, the 'Anxiety regarding children' score was found to be significantly higher among mother of the LBW group, compared to mothers of infants with other disorders. This survey revealed particularly high 'ZSDS scores' and 'Anxiety regarding children' scores for the mothers of the LBW group among the NICU mothers, which may be further indication of some factor affecting the mental health of LBW group mothers

in different manner from the mothers of infants with other afflictions necessitating NICU care. However, almost no work has been carried out on this perspective and further evaluation is believed necessary.

The results obtained this time indicate the necessity of psychological approaches to mothers of infants admitted to the NICU, and for the mothers of LBW infants in particular. Mental instability immediately after birth and higher anxiety have actually been demonstrated through interviews of mothers of very low birth weight infants (Nagata *et al.*, 1997). And then, there are the reports on the existence of a high proportion of LBW infants among abused children (Elmer and Gregg, 1967; Klein and Stem, 1971; Hunter *et al.*, 1978; Friedrich and Einbender, 1983). Although these facts may not be directly associated, it is believed there is ample urgency in the need to provide a system of multidimensional support-particularly forms of intervention aimed at facilitating the mother to elicit social support from significant others-for alleviating the anxiety of these mothers.

Path Analysis

Next, as the result of path analysis, significant paths were obtained between 'ZSDS scores' and both 'Core maternal attachment' and 'Anxiety regarding children' for the NICU mothers, similar to the mothers of full-term infants. It was indicated that when ZSDS scores were high, the mother's attachment to her child was weak and anxiety was high. Additional path analysis based on the results of exploratory correlation analysis demonstrated no correlation between 'ZSDS score' and 'Peripheral support', or 'Presence nearby of mothers with children in the same age group', both factors which were seen to influence 'ZSDS score' in the mothers of full-term infants (-0.15 $p < 0.01$, -0.10 $p < 0.05$). A child's admission to the NICU is a totally unexpected development for most mothers, and life after discharge is beyond imagination for many at least in the early stage (Nagata *et al.*, 1997). It is believed support in the form of care or advice regarding everyday child-rearing practices or social factors such as the presence nearby of mothers with children in the same age group may be of minor significance under such circumstances. On the other hand, a significant path coefficient was obtained for the 'Father's reaction in learning of the pregnancy', which was not seen to have any association with 'ZSDS score' in the mothers of full-term infants. This indicated that when the father's reaction to the pregnancy was negative, there was a tendency for elevation of ZSDS scores. To date, there have been studies emphasizing the psycho-social factors apart from the endocrine factors as factors of transient puerperal depression (Kennerley and Gath, 1989), while Paykel *et al.* (1980) report on the effect of

the husband-wife relationship. Younger *et al.* (1997) in a study on mothers of preterm infants, report inverse correlation between depression and the existence of various forms of social support, pointing out the importance of social support for the prevention of depression also in the case of preterm infants. However, our results may be taken as indication that in face of a critical condition necessitating NICU hospitalization, it is the close emotional support of the father nearby that is more pertinent than the existence of other modes of peripheral support.

As stated before, we obtained significant path coefficients between 'ZSDS score' and both subscales of 'Postpartum maternal attachment'—'Core maternal attachment' and 'Anxiety regarding children'—in the NICU mothers similar to the control mothers of full-term infants. We believe these findings indicate that the mother's puerperal depression does indeed influence attachment to children. We believe it necessary to delve further into how this maternal attachment is associated with actual mother-child interaction not only in full-term infants but in NICU-admitted infants as well, for assessment of the transition in maternal attachment from this early period on. On the other hand, regarding the NICU mothers, a significant path coefficient (0.31, $p < 0.001$) was obtained between 'Core maternal attachment' and the 'Father's reaction in learning of the pregnancy'. When the father's response was positive, core maternal attachment scores were high. This path coefficient was higher than that obtained for the control mothers of full-term infants (0.12, $p < 0.05$). Furthermore, among the NICU mothers, a significant path was determined between 'Anxiety regarding children' and the child's birth order. The lower the birth order, the higher the 'Anxiety regarding children', which is consistent with the reported notion that anxiety is higher in primiparas and in the presence of problems during pregnancy (Mochimaru, 1989).

Clinical Implications and Perspectives for Future Study

It has been noted that active psychological support is necessary for mothers in puerperium. It has also been indicated that active intervention for depression in the early postpartum period is necessity for wholesome development of the mother-child relationship in the early stages, which can be crucial for mother and child coming face-to-face with the critical situation involving NICU hospitalization, shaken both physically and mentally. In the actual clinical setting, cases of parents at a loss of how to raise their child of those coming to harbour relational difficulties following discharge from the NICU have come to notice, and attempts to provide psychological care to both parents and child within the NICU (Hashimoto, 1996; Nagata, 2002) or Kangaroo care' (Gene, 1991) promoting mother-child interaction from an early stage are starting to be

seen. As such, with various approaches being taken given rising recognition of the importance of extending psychological support to mothers during NICU hospitalization, concurrent effort must now be taken on evaluate the effectiveness of such psychological support, the effects of NICU hospitalization on mutual interaction between mother and child, and these effects on the cognitive development of the child through long-term followup. In this context, we hope the next step in our study on how both NICU and control mothers with depression in the postpartum period will fare over time, and its effect on the emotional and cognitive development of the child will contribute to further understanding of this quite substantial issue.

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