Research paper

Associations between broader autism phenotype (BAP) and maternal attachment are moderated by maternal postpartum depression when infants are one month old: A prospective study of the Japan environment & children's study

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ABSTRACT

Background: Broader autism phenotype (BAP) refers to the expression of behavioral and cognitive dispositions similar to autism spectrum disorder. The present study investigated whether mothers' BAP was prospectively associated with maternal attachment, and if postpartum depression modified this association.
Methods: The Japan Environment and Children's Study (JECS) is a national and government-funded birth cohort study that began in January 2011. Among the 103,099 mothers enrolled, 87,369 mothers without a history of depression were included in the analysis. Self-administered questionnaires were used. These included: the Japanese version of the Autism Spectrum Quotient, the Mother to Infant Bonding Scale, and the Edinburgh Postnatal Depression Scale. Logistic regression analyses were performed.
Results: The BAP during the second or third trimester of pregnancy was linearly associated with an increased risk of postpartum depression and insecure maternal attachment when infants were one month old (p for trend < 0.001), after adjusting for confounding variables. When stratified by postpartum depression, among the BAP subscales, deficiencies in social skills and communication were associated with an increased risk of insecure maternal attachment in mothers without postpartum depression. The relationships between the BAP subscales and maternal attachment were attenuated among mothers with postpartum depression.
Limitations: Only five items of the Mother to Infant Bonding Scale were used in the present study, and thus the results should be interpreted with caution.
Conclusions: Mothers' BAP was predictive of insecure maternal attachment toward their infant. Postpartum depression partially moderated the associations between mothers' BAP and insecure maternal attachment.

1. Introduction

Recently, broader autism phenotype (BAP) has been the focus of research studies. BAP refers to the expression of behavioral and cognitive dispositions similar to autism spectrum disorders, but at sub-threshold levels (Asano et al., 2014; Dawson et al., 2007). Previous studies revealed that individuals with BAP had deficits in social

motivation and communication; impairments in facial processing and executive functioning; and lower levels of motor imitation and language (Asano et al., 2014; Dawson et al., 2002; 2005; Piven et al., 1997; Sucksmith et al., 2011).

Maternal personality traits can affect parenting style (Pluess and Belsky, 2010; Kornienko, 2016). For example, mothers' emotion-related personality traits such as sociability and empathy predict the quality of

infant-mother attachment (Izard et al., 1991). Maternal attachment allows mothers to invest efforts into meeting infants' needs by taking over the demanding chores of child rearing (Tiez et al., 2014), and is expressed via cuddling and smiling towards the infant (Reck et al., 2006). However, insecure maternal attachment (i.e., impaired bonding and bonding disorder) may be accompanied by feelings of irritability, hostility, aggressive impulses, or rejection directed towards the child (Brockington, 2004). A previous study (Moehler et al., 2006) indicated that maternal mental state during the first four months postpartum was particularly important for later mother-child relationship quality. Previous studies also suggest that child difficulties in later life may be caused by an impaired mother-child relationship (Moehler et al., 2006; Murray et al., 2003; Miklush and Connelly, 2013). Maternal BAP may be an important predictor of maternal attachment.

Previous studies indicate that mothers' postpartum depression may affect their affective bonding, including positive feelings and emotional warmth toward infants (Behrendt et al., 2016; Moehler et al., 2006; Tietz et al., 2014; Wilson and Durbin, 2010). Indeed, maternal postpartum depression is an important factor to consider when investigating maternal attachment. Furthermore, Asano et al. (2014) revealed that Japanese mothers' BAP was associated with postpartum depression. Maternal BAP may lead to postpartum depression and, in turn, to an insecure maternal attachment toward an infant. However, to the best of our knowledge, the associations between mothers' BAP, postpartum depression, and maternal attachment after birth have not been investigated in a prospective study design with a large sample.

The purpose of the current study was to investigate the associations between mothers' BAP, postpartum depression, and maternal attachment by studying a large, representative sample of Japanese mothers with a prospective design. The Japanese version of the Autism Spectrum Quotient (AQ) (AQ-J-10: Kurita et al., 2005) was used to assess mothers' BAP. The AQ-J-10 consists of four subscales: social skills, attention switching, communication, and imagination. Specifically, we investigated the following hypotheses: (a) mothers' BAP would be linearly associated with an increased risk of postpartum depression (consistent with findings from Asano et al. (2014)) as well as an insecure maternal attachment; (b) among the BAP components, social skills and communication, which are particularly related to sociability, would be predictive of the quality of maternal attachment, consistent with findings from Izard et al. (1991); (c) postpartum depression would modify the associations between the BAP components and maternal attachment because postpartum depression may inhibit the development of maternal attachment, consistent with findings from previous studies (Behrendt et al., 2016; Moehler et al., 2006; Tietz et al., 2014; Wilson and Durbin, 2010).

2. Methods

2.1. Study design

The Japan Environment and Children's Study (JECS) is a national, government-funded birth cohort study; mothers were first recruited into the study in January 2011. A total of 15 regional centers (Hokkaido, Miyagi, Fukushima, Chiba, Kanagawa, Koshin, Toyama, Aichi, Kyoto, Osaka, Hyogo, Tottori, Kochi, Fukuoka, and south Kyushu/Okinawa) were selected. Women were recruited in early pregnancy at obstetric facilities and/or at local government offices issuing pregnancy journals (Mother-Child Health Handbooks). Recruitment started in January 2011 and continued for three years (until March 2014).

The JECS protocol is published elsewhere (Kawamoto et al., 2014), and the details of the JECS project are described in previously published studies (Kawamoto et al., 2014; Michikawa et al., 2015; 2017; Suzuki et al., 2016). The present study is based on the jecs-ag-20,160,424 dataset, which was released in June 2016 and revised in October 2016. The dataset includes data from the following time points: enrollment

during the first trimester of pregnancy; during the second or third trimester; at delivery; and when infants were one month old.

2.2. Ethical issues

The JECS protocol was approved by the Ministry of the Environment's Institutional Review Board on Epidemiological Studies, and by the ethics committees at all participating institutions. Written informed consent was obtained from all participating women.

2.3. Participants

Among the 103,099 participating mothers, there were 5,140 who had a history of depression, anxiety, or schizophrenia; 3,285 mothers' previous history was missing. Mothers with a history of depression, anxiety, or schizophrenia, and those with missing data, were excluded from the analyses. Among the 94,674 mothers without a history of psychiatric problems, 7,063 were missing scores for broader autism phenotype and maternal attachment; they were excluded from the analysis. Among 87,611 mothers, 209 mothers were excluded because they either delivered a stillborn baby, or were missing information on age or postpartum depression. In the final sample, 15 mothers reported having attention-deficit hyperactivity disorder (ADHD), nine mothers reported having a learning disorder (LD), seven mothers reported having a pervasive developmental disorder (PDD), and five mothers reported having another developmental disorder. In total, 33 mothers reported having developmental disorders (two of whom had both ADHD and PDD, and one other had both LD and PDD), and they were also excluded from the analyses. A total of 87,369 mothers were included the final analysis. Participants' demographic data are shown in Table 1.

2.4. Questionnaires

The Japanese version of the Autism Spectrum Quotient consists of 10 items (AQ-J-10; Kurita et al., 2005) and was used to measure mothers' BAP. The AQ-J-10 is a self-administered questionnaire, and it is based on the AQ; the AQ was developed by Baron-Cohen et al. (2001) and is used to screen adolescents and adults with high-functioning pervasive developmental disorders. The original 50-item questionnaire was reduced to 10 items to create a short form of the AQ. The short form is a reliable and valid measure (Kurita et al., 2005). The AQ-J-10 has four subscales: social skills (3 items, e.g., "Hard to work out another's intention"); communication (2 items, e.g., "Often the last to understand a joke"); imagination (4 items; e.g., "Hard to imagine what it's like to be someone else" ; and attention switching (1 item, e.g., "Tend to have strong interests"). The participants rated by themselves on a 4-point scale with the following options: definitely agree, slightly agree, slightly disagree, and definitely disagree. Ratings of agree (definitely or slightly) were scored as "1," and ratings of disagree responses (definitely or slightly) were scored as "0". Higher scores indicate higher autistic personality traits. A score of 7 is the recommended cutoff value for predicting the presence of PDD (Kurita et al., 2005). Based on the quartile scores from the distribution, participants with normal values from 0 to 6 were grouped into four quartiles: there were 20,233 participants in quartile 1 with scores of 0–1; 22,436 in quartile 2 with scores of 2; 19,963 participants in quartile 3 with scores of 3; and 22,517 in quartile 4 with scores from 4 to 6. Another group with high scores from 7 to 10, based on the cutoff value, consisted of 2,220 participants.

A Japanese version of the Mother to Infant Bonding Scale (MIBS: Yoshida et al., 2012) was used to assess maternal attachment. The MIBS, which is a self-administered questionnaire, was originally developed by Kumar (1997) and Yoshida et al. (2012) translated the MIBS into Japanese and reported that the validity and reliability were at acceptable levels (Yoshida et al., 2012). Five of the 10 original items,