Acoustic alterations of ultrasonic vocalization in the autism model mice (duplication of 15 q11-13)

upon maternal isolation

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INTRODUCTION

Gene mutations are main factors to cause Autism spectrum disorder (ASD) and various model mice are developing based on gene mutations. One of them is the B6.129S7-Dp (7Herc2-Mkrn3) 1 Taku model mouse that has the duplication of 15 q11-13. We used this ASD model mouse and examined pup–dam communication upon maternal isolation.

OBJECTIVES

We recorded ultrasonic vocalizations (USVs) emitted by the model pups upon maternal isolation and compared them with those emitted by the wild type. Our objective is to examine whether the model pups display acoustic alterations of USVs to call their dam, suggesting alterations of pup–dam communication.

MATERIALS and METHODS

The ASD model pups were four patDp/+ pups with a 6.3 Mb duplication on chromosome 7 corresponding to the duplication of human chromosome 15q11-13 (Nakatani et al, 2009). The control pups were seven wild-type pups of C57BL/6J. Each pup was individually isolated from the dam and littermates and put into a transparent cage, set at a soundproof chamber. The ultrasound microphone was located upper side of the cage. The USVs emitted by a pup were repeatedly recorded for 5 min on postnatal days (PNDs) 4, 7, 10, 13, 16, and 19 and analyzed by using the Sonotrack System v 2.4 and Call Classification Software for Mice v 1.4.3 (Metris). Acoustic characteristics of USVs produced by the patDp/+ were compared with those produced by the wild-type.

RESULTS

The *patDp*/+ displayed remarkable increases of USVs on PNDs 10 (p < 0.001) and 13 (p < 0.05) compared with the wild-type, particularly USVs with longer durations (15–100ms), frequency-modulation (more than 2 kHz change), and 2 syllables on PNDs 7, 10, and 13 (p < 0.05). In contrast, the wild-type displayed increases of USVs with shorter durations (4–15ms), flat frequency (less than 2 kHz change), and 1 syllable on PNDs 7, 10, and 13. USVs were classified into 14 categories based on syllable, duration, and frequency-modulation. The *patDp*/+ produced more USVs categorizing into Down and Step Up types, whereas the wild-type produced more USVs categorizing into Short type.



CONCLUSIONS

The reductions of brain serotonin levels were revealed in the *patDp*/+ for the first few weeks after birth (Tamada et al., 2010). Abnormalities of brain serotonin levels suggest latent elevations of anxiety. Maternal isolation induces higher anxiety because pups are unable to survive without maternal care. Accordingly, the *patDp*/+ exhibited prominent increases of USVs to call the dam due to much higher anxiety.

REFERENCES

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