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学位論文の内容の要旨

(Summary of the Substance of Dissertation)

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論文題目(Thesis
Subject)

4D ultrasound study of fetal facial expressions in the third trimester of pregnancy

(論文要旨)

(Summary)

<Objective>

Fetal behavior represented by fetal movements and facial expressions reflects well-being of the fetal brain and central nervous system (CNS). Therefore, the evaluation of facial expressions, especially in the third trimester of pregnancy, might represent a direct method to assess developmental changes of the fetal brain and CNS. The aim of this study is to evaluate the frequencies of fetal facial expressions in the third trimester of pregnancy, when fetal brain maturation and development are progressing in normal healthy fetuses.

<Methods>

Four-dimensional (4 D) ultrasound was used to examine the facial expressions of 111 healthy fetuses between 30 and 40 weeks of gestation. The frequencies of seven facial expressions (mouthing, yawning, smiling, tongue expulsion, scowling, sucking, and blinking) during 15-minute recordings were assessed. The fetuses were further divided into three gestational age groups (25 fetuses at 30–31 weeks, 43 at 32–35 weeks, and 43 at ≥36 weeks). Comparison of facial expressions among the three gestational age groups was performed to determine their changes with advancing gestation.

<Results>

Mouthing was the most frequent facial expression at 30–40 weeks of gestation, followed by blinking. Both facial expressions were significantly more frequent than the other expressions ($p < 0.05$). The frequency of yawning decreased with the gestational age after 30 weeks of gestation ($p = 0.031$). Other facial expressions did not change between 30 and 40 weeks. The frequency of yawning at 30–31 weeks was significantly higher than that at 36–40 weeks ($p < 0.05$). There were no significant differences in the other facial expressions among the three gestational age groups.

<Discussion>

Mouthing was the sole most frequent facial expression at 20-34 weeks in our previous studies. In the present study, mouthing and blinking were the most frequent facial expressions at 30-31, 32-35, 36-40, and 30-40 weeks of gestation, respectively. Brain functions regulate the rate of spontaneous eye blinking, and an increase in the spontaneous eye-blinking rate is thought to be related to central dopamine system maturation. These results suggest that the concurrence of mouthing movement and eye blinking may be related to the maturation of fetal brain development after 30 weeks of gestation.

Yawning is concerned with the arousal process of the brain. With advancing gestation, the rhythmic control of sleep and wake times becomes more established. This results in frequent waking episodes and less of a need for yawning as a stimulus for brain arousal. The period of approximately 30 weeks of gestation might represent the emergence of distinct states of fetal brain arousal as indicated by significant decrease in yawning frequency.

<Conclusions>

The present study provided the normal parameters of fetal facial expressions in the third trimester of pregnancy, and suggests the possible link between facial expressions and brain development at this stage, when the fetal brain reaches advanced stage of maturity. Therefore, the full realization of fetal facial expressions and fetal behavior in different stages of gestation might enable us to better understand the functional development of the fetal brain and CNS. The developmental changes of facial expressions can selectively indicate the maturation and development of different parts of the fetal brain and CNS.

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(備考) 論文要旨は、日本語で1,500字以内にまとめてください。
 (Recital) Sum up the summary within 1500 letters.