

Fetal Hypoxia

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Intrauterine fetus tends to be hypoxic, because a fetus is oxygenated via placental transfer, and umbilical arterial blood PO_2 is usually below 50 mmHg which is hypoxic if compared to an adult PaO_2 . It is hazardous due to neuronal cell necrosis or general organ damages in severe fetal hypoxia, then it is estimated by fetal heart rate (FHR) monitoring, pulse oxymetry, scalp blood pH, pulsed Doppler fetal arterial blood flow, percutaneous oxymetry, infrared brain oxygenation, etc., while the most common clinical method will be FHR monitoring, because, the hypoxia suppress or damage central nervous system represented by the loss of acceleration and baseline variability, para-sympathetic vagal center of medulla oblongata is excited by the hypoxia, and develop fetal bradycardia [1], i.e. rabbits heart rate closely correlated to PaO_2 , then the heart rate decreases when PaO_2 lowered [2]. Similar FHR changes are expected in fetal hypoxia, i.e. fetal hypoxia is diagnosed by FHR changes.

The early FHR sign of hypoxia will be transient bradycardia (deceleration), where late deceleration is particularly concerned. Also the loss of acceleration against fetal movement (non-reactive FHR) is important, i.e. it may be followed by severe hypoxic FHR changes [3]. Severe variable deceleration is also one of hypoxic signs. The loss of variability will be the sign of fetal brain damage [2], i.e. some of them can follow cerebral palsy (CP). Therefore, Cesarean section (C-section) should be performed before the loss of variability [2]. The decision of C-section will be difficult without the impact level of hypoxia to develop brain damage. The decision will be made by the lowest FHR of bradycardia and the duration of bradycardia. The combination of two parameters is the hypoxia index, which is the bradycardia duration (min) divided by the lowest FHR (pm) $\times 100$ in the bradycardia. Each hypoxia indices are summarized in multiple bradycardias. Since the

hypoxia index was 25-26 in cases of the loss of variability or brain damage, the C-section will be performed when the hypoxia index is more than 20 and less than 25. i.e. 20-24 at present [2]. The hypoxic index to perform C-section will be established after more studies.

Since FHR pattern diagnosis was subjective and individual in each pattern, comprehensive evaluation was needed for the fetal diagnosis. Maeda objectively analyzed FHR baseline and deceleration, and evaluation score was determined in each changes by the percentage of low Apgar score, and summarized evaluation scores in 5 min to obtain comprehensive FHR score, where 10-19 FHR score was abnormal and 20 or more was highly abnormal. The FHR score in the first stage of labor closely correlated to Apgar scores and umbilical cord arterial blood pH [1]. The FHR score was obtained by computerized analysis. Another comprehensive and objective FHR diagnosis was artificial neural network system [1]. Automated frequency analysis of FHR diagnosed sinusoidal FHR separating physiological sinusoidal FHR. Gathering these methods, centralized automatic computer diagnosis was completed and has been clinically utilized with superb results.

References

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