

Prevention of Cerebral Palsy Caused By Intrapartum Fetal Brain Damage with Novel Hypoxia Index

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ABSTRACT

Aims: Late deceleration (LD) was known to relate to ominous outcome. However, even 3 connected LDs resulted in vigorous neonate. A possible contradiction were there to be elucidated. An early delivery may not prevent cerebral palsy after the loss of fetal heart rate (FHR) variability, as it is the sign of fetal brain damage. Thus, the vicious signs should be predicted before arriving disaster.

Methods: Some recommendations were proposed; early delivery in the loss of FHR acceleration or repeated decelerations, however, there was no description concerning the number of decelerations. Taking these into account, all of late, early, variable decelerations and sudden acute continuous FHR bradycardia were studied using novel hypoxia Index (HI), which was the sum of duration (min) of decelerations divided by the lowest FHR (bpm), and multiplied by 100. Among cases with HI values 25 and 26 developed the loss of FHR variability followed by fetal brain damage and cerebral palsy, while cases with HI 20-24 in abnormal FHR developed neither loss of variability nor cerebral palsy.. The preceded study thus suggested a feasibility of early delivery when HI was increasing in the level below 25.

Results and discussion: The HI of 3 LDs was 6 and its neonate was vigorous, while HI was 26 in the loss of variability and infantile brain damage in repeated LDs in 50 min, where the discrepancy of LD was solved by the HI. Also, the HI was 25 in the loss of variability followed by cerebral palsy, while there was neither loss of variability nor cerebral palsy in cases HI being 20-24.

Conclusion: The threshold of HI was 25 to develop the loss of variability followed by fetal brain damage and cerebral palsy. An early delivery is recommended, when the HI is increasing in the level below 25, thus, the HI is verified to incorporate in the soft wear of computerized FHR monitoring.

KEYWORDS

Fetal Heart Rate; Late Deceleration; The Loss Of Variability; Fetal Brain Damage; Cerebral Palsy; Hypoxia Index; Early Delivery.

INTRODUCTION

The discrepancy of late deceleration (LD) was controversy, namely, its outcome was reported ominous [1], while the case of 3 connected LDs achieved vigorous neonate of which Apgar score was 9, though the neonate was severe asphyxia, whose Apgar score was 3 and associated the loss of FHR variability and severe infantile brain damage in a repeated LD case for 50 min due to refusal of caesarean delivery. The discrepancy of LD should be analyzed. Another case was a severe intrapartum FHR abnormality developing the loss of variability

followed by cerebral palsy. Thus, the prediction of the loss of FHR variability followed by cerebral palsy should be studied in fetal monitoring.

METHODS

As the late deceleration is defined by some authors when the characteristic deceleration pattern is repeated for 15 minutes, thus, late decelerations reported in the past may be studied in group formed by its repetition, where total dip area of repeated LD in 15 min is larger than single LD. Thus, the author

planned to analyse decelerations as a group in the course of labour.

Since hypoxia stimulates parasympathetic center of medulla oblongata developing vagal excitation and bradycardia, which is closely correlated hypoxia, namely, rabbit heart rate decreased parallel to the decrease of PaO₂, when the PaO₂ was less than 50 mmHg [2], and human umbilical cord blood PaO₂ was less than 50 mmHg. [3], thus, fetal bradycardia is able to study as the sign of hypoxia in FHR deceleration, instead of cord blood sampling in the uterus during labor..

The hypoxic effect will be minor when the duration of hypoxia is short in cases of 2-3 decelerations, while the effect will be prominent if the decelerations repeated, namely, 2-3 decelerations develop minor hypoxic effect, and highly repeated decelerations would develop clear damaging effect, thus the basis of HI is the summation of deceleration durations in the course of labor, which was divided by the lowest heart rate as the intensity of hypoxia, namely, the HI of single deceleration correlates the dip area. The sum of deceleration duration divided by nadir heart rate will be similar to the sum of dip areas, which will show total hypoxic effects.

RESULTS AND DISCUSSION

The hypoxia index of 3 LDs was 6, and the Apgar score was 9, thus the neonate was vigorous, while the HI of 50 min' LD repetition was 26, showing the loss of FHR variability and fetal brain damage, where the LD discrepancy is understood as the result of the summation of deceleration. The particular shape of LD will be explained by its developing process, which was caused by the compression of pelvic arteries by contracted pregnant uterus, stopping placental maternal circulation after the labor contraction, which was certified by pelvic arterial angiography [4], but not the insufficiency of placental villi function, because the LD disappeared by the lateral posture of the mother [5]. The discrepancy of LD was clarified by its developing process and HI.

As the threshold HI level was 25 to predict cerebral palsy in the studies on repeated decelerations, intrapartum fetal brain damage followed by infantile cerebral palsy will be prevented by the early caesarean delivery performed when the increasing HI level is below 25 at delivery [6]. Although one fetal brain damage was developed in 5,000 deliveries, it is not rare, because the cerebral palsy will be 200 cases in 1,000,000 births in a year in Japan.

Although Deceleration type was important in the past FHR pattern diagnosis, the repetition of deceleration and the labor process were novel factors to predict fetal outcome after introduction of hypoxia index, because the mostly frequent repetition of deceleration is late deceleration, as it developed

in every labor contraction, while variable deceleration was less frequently repeated, since its appearance was variable., The early deceleration will be benign, because fetal head compression appears in short period of passing through pelvic canal, and mild variable deceleration is variable and its nadir heart rate is high resulting the most mild hypoxic effect.

Anyway, the monitoring work was simplified by the introduction of single hypoxia index instead of early, late, severe and mild variable decelerations. The hypoxic effect of HI will be the same as deceleration pattern classification, because fetal damage detection is superior in hypoxia index because HI evaluates full course of labor, while pattern classification will be limited, while the purpose is the same in both methods. You can select any type of monitoring, subjective visual pattern classification or objective mathematical HI by the preference of user, when an acto-cardio-tokogram is used, though computerized calculation of HI is superior in its utility and working volume, but economically somewhat expensive. Advantage of hypoxia index is its objective nature to numerically evaluates the hypoxic effect to prevent infantile cerebral palsy, which was not focused in the pattern classification monitoring.

In addition, even the sudden acute continuous bradycardia is supported by the hypoxia index, where remained minutes before the hypoxic ischemic encephalopathy is obtained. Automatic, direct and rapid report to the doctor can be achieved if it is programmed in a computer.,

Although there are other origins to develop cerebral palsy in perinatal medicine, the disorder caused by intrapartum damage was studied with novel hypoxia index to prevent it.

CONCLUSION

The discrepancy of late deceleration was analyzed, the complicated problem of FHR pattern classification was solved, and intrapartum fetal brain damage followed by cerebral palsy are prevented, after introduction of objective and numeric hypoxia index into FHR diagnosis.

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