

Cerebral Palsy caused by Intrapartum Fetal Damage is Prevented by the Hypoxia Index

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Abstract

Aims: To prevent cerebral palsy caused by intrapartum damage.

Methods: Hypoxia index is the sum of deceleration durations (min) divided by the lowest fetal heartrate. And multiplied by 100.

Results: Hypoxia index of 6 cases of cerebral palsy were 25 or more and the index was 24 or less in 16 cases of no cerebral palsy.

Conclusion: Cerebral palsy will be prevented if the fetus is delivered when hypoxia index is 24 or less at delivery.

Keywords: Fetus, delivery, hypoxia index, fetal heart rate, deceleration, cerebral palsy, prevention.

INTRODUCTION

The loss of fetal heart rate (FHR) variability followed by infantile cerebral palsy is caused by intrapartum fetal brain damage, while there was no numeric index to show fetal heart rate (FHR) abnormality in past fetal monitoring, thus, it was difficult to prevent cerebral palsy in the past, thus the author studied the late FHR deceleration (transient fetal bradycardia), which caused fetal brain damage by frequently repeated FHR decelerations but not by the rare deceleration pattern [1].

METHODS

Thus, the hypoxia index (HI) was created, which was the sum of deceleration durations (min), that was hypoxic duration, divided by the lowest FHR (bpm, beats per min), of deceleration, which showed the hypoxia intensity, and multiplied by 100 to keep it to be integer.

The HI used heart rate (HR) instead of PaO₂ (arterial oxygen pressure), because heart rate was parallel to

PaO₂, when it was lower than 50mmHg [2], human fetal PaO₂ was lower than 50mmHg [3], and umbilical cord blood sampling is hard during labor.

Thus, the index indicates the grade of hypoxia, which may cause the loss of viability and fetal brain damage followed by cerebral palsy. As the index did not use the lag time between uterine contraction, all of early, late and variable decelerations, in addition continuous fetal bradycardia were studied by hypoxia index in full course of fetal monitoring, while the deceleration pattern was useless to diagnose fetal outcome in fetal monitoring. Thus, computerized FHR diagnosis should incorporate the software of hypoxia index, instead of FHR pattern classification (Figure 1).

The author collected 6 cases of cerebral palsy, which developed the loss of variability, in intrapartum fetal monitoring and cerebral palsy, and 16 cases of neither loss of variability nor cerebral palsy. Their FHR decelerations were measured after the births and their hypoxia index were calculated.

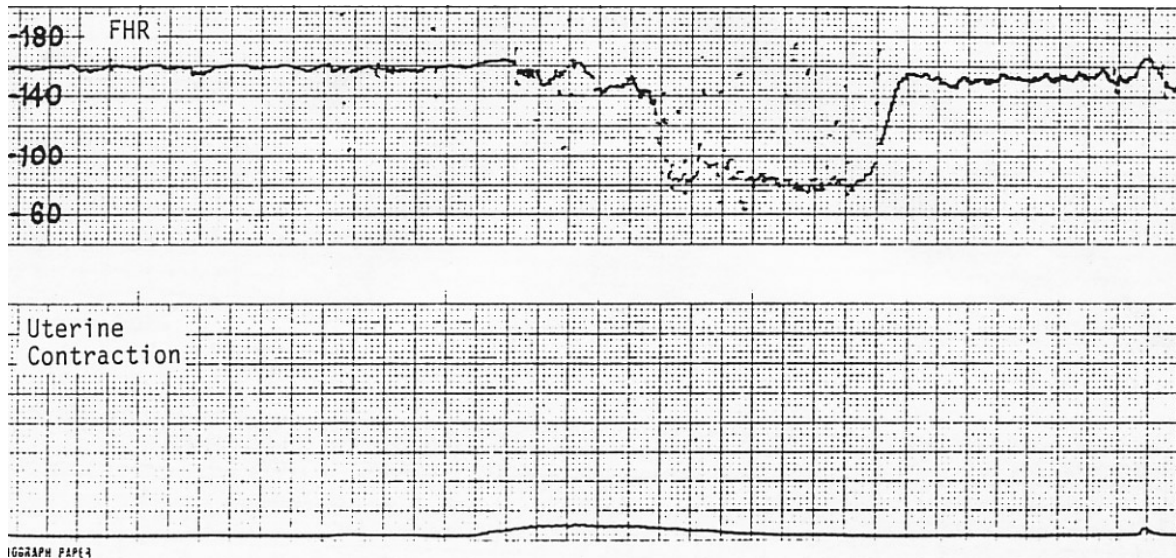


Figure 1. An example of FHR deceleration is shown by aperture of FHR curve, where the deceleration duration and the lowest FHR are measured..The two data are conveniently measured by a fetal monitoring computer instead of manual measurement.

RESULTS

The hypoxia index were 25 or more in all of 6 cases who developed cerebral palsy, and the hypoxia index of

16 cases who developed no cerebral palsy were 24 or less, where significant difference was noted between the development of cerebral palsy (Table1).

Table 1. Chi square test of cases whose hypoxia index were 25 or more and 24 or less. $p=0,000008<0.05$ significant difference.

| Hypoxia Index | Cerebral palsy | |
|---------------|----------------|----|
| | Yes | No |
| 25 or more | 6 | 0 |
| 24 or less | 0 | 16 |

DISCUSSION

Thus, cerebral palsy development threshold of hypoxia index exists between 24 and 25, therefore, there will be no cerebral palsy, if hypoxia index is 24 or less at delivery. The attending doctor should be careful at the positive hypoxia index, which means the presence of FHR deceleration, then watch the increasing tendency of the index. Early caesarean delivery should be prepared before the index reaches 24. Since the loss of variability is the sign of severe hypoxic fetal brain damage, followed by cerebral palsy, early delivery by caesarean delivery should be performed before the loss of variability. The caesarean delivery after the loss of FHR variability will prevent fetal demise, while it is difficult to prevent fetal brain damage followed by cerebral palsy. Therefore, the loss of variability should be predicted by the increasing hypoxia index approaching threshold but less than 24. The

application of the loss of FHR acceleration and the decrease of variability to 5 bpm will be the prodromal sign of the loss of variability in Actocardiogram [2].

Thus, the hypoxia index should be incorporated in the program of computerized fetal monitoring, e.g. the estimation of the time to 24 of hypoxia index. to establish safe birth of fetus. though it is even manually calculated. Automated fetal monitoring computer will be activated by 1) FHR score calculated every 5 minutes to diagnose neonatal Apgar score and pH of umbilical cord blood[[3], 2) Hypoxia index is calculated in every deceleration in full course of labor to keep normal neonates without cerebral palsy, and 3) frequency spectrum analysis to diagnose pathologic sinusoidal FHR[4]. The three parameters are obtained only by fetal heart rate curve, while fetal movement is analyzed by particular program connecting actocardiogram.

CONCLUSION

Since the hypoxia index is the reliable indicator of fetal outcome, it is indispensable to achieve numeric parameter of intrapartum fetal monitoring, it is incorporated in fetal monitoring computer to reduce cerebral palsy caused by intrapartum damage.

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