Case 42 (Unknown or unspecified causes- 10)

Summary

Gestational weeks 41 weeks' gestation **Risk factors** Threatened preterm delivery **Birth weight** 4100 g level

Delivery course The woman was admitted to hospital because of labor pains. ▶ Epidural anesthesia was performed. Oxytocin drip infusion was used for augmentation of labor. ▶ Vacuum extraction was tried for the diagnosis of non-reassuring fetal status. ▶ Cesarean section was performed.

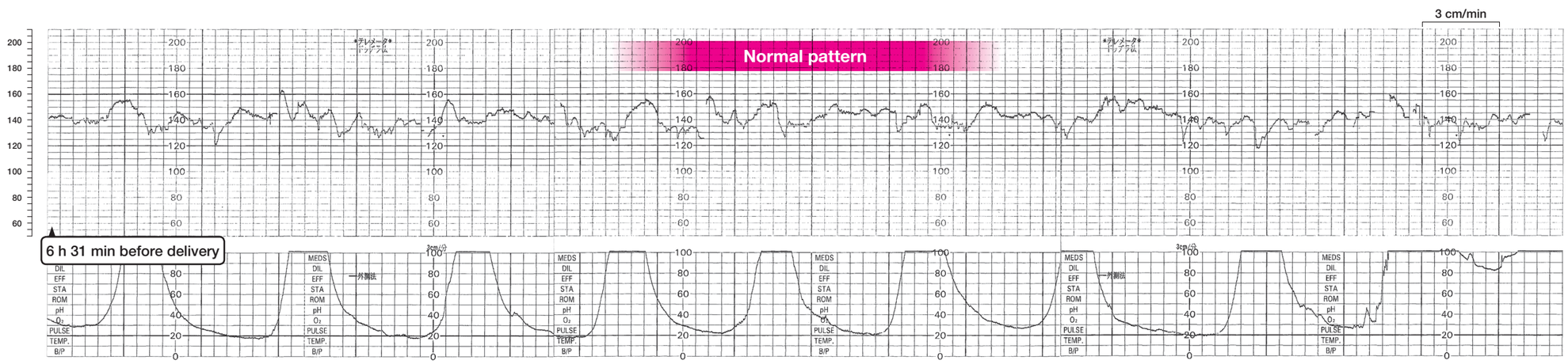
During hospitalization

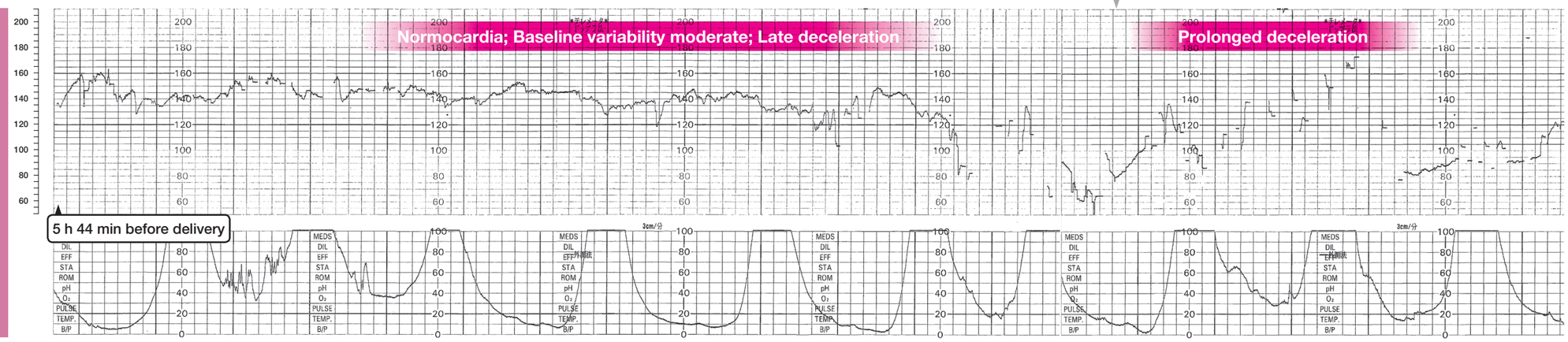
13 h 47 min before delivery
Onset of labor

11 h 37 min before delivery
Admission; Cervical dilatation 5 cm

9 h 17 min before delivery
Cervical dilatation 7 cm
Epidural anesthesia begun.

7 h 47 min before delivery
Augmentation of labor with oxytocin drip infusion begun.





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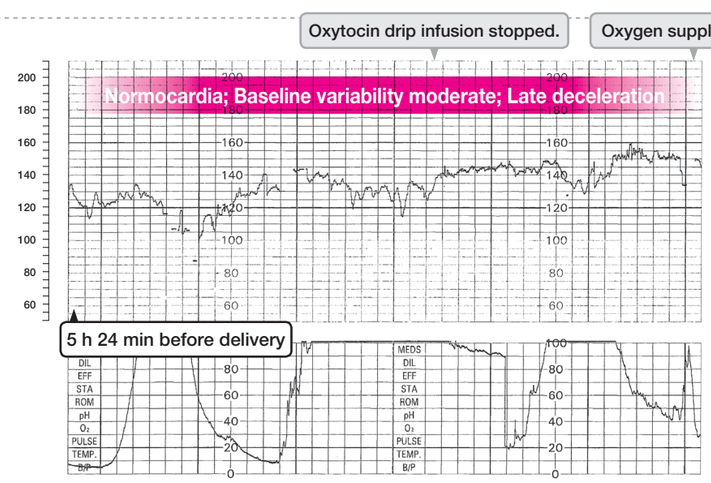
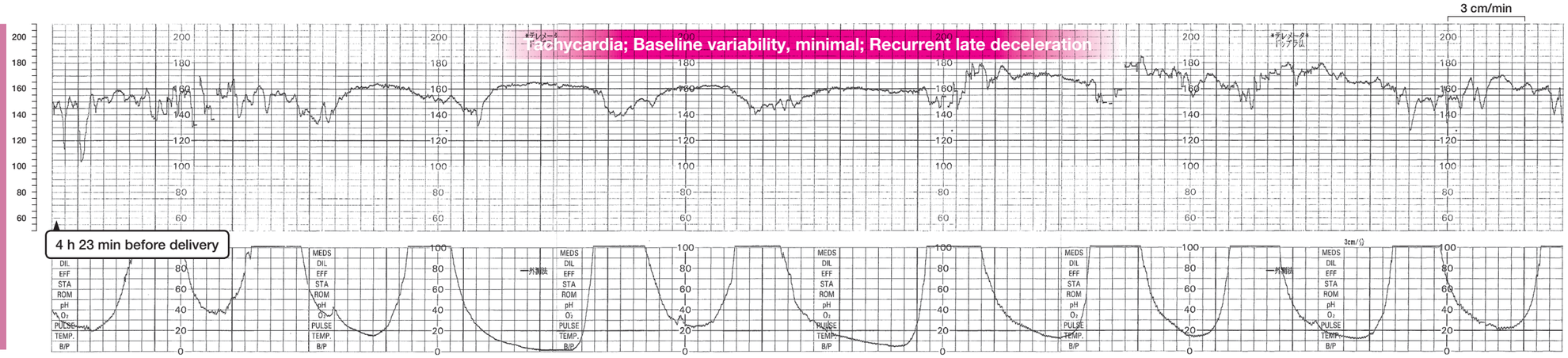


5 h 12 min before delivery
Oxytocin drip infusion was re-started.

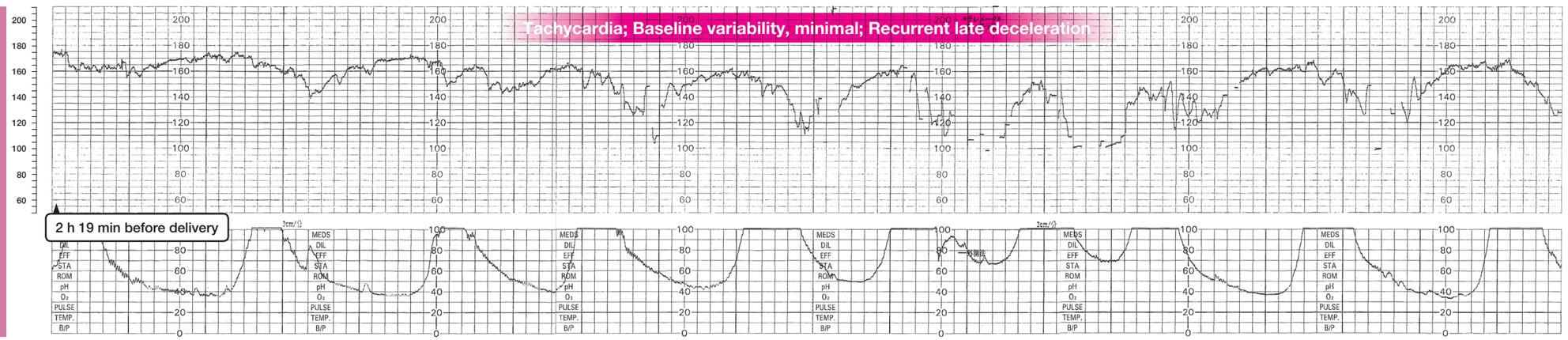
5 h 2 min before delivery
Artificial rupture of membranes; No meconium staining

During hospitalization



3 h 47 min before delivery
Almost full dilatation of cervix

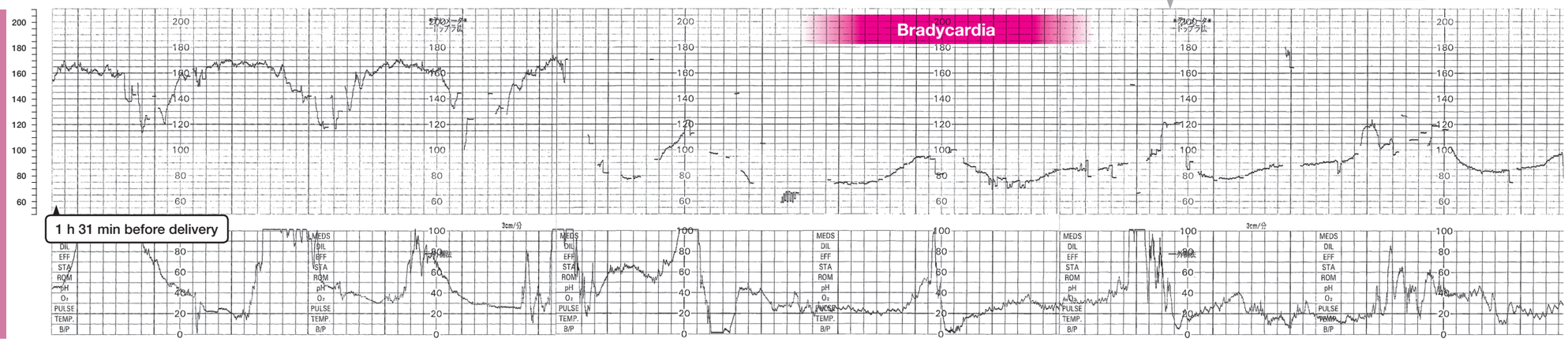
During hospitalization



1 h 42 min before delivery
Oxygen supplementation begun again.

Full dilatation of cervix
Vacuum extraction (using Kristeller's maneuver (uterine fundal pressure)) begun.

Before delivery



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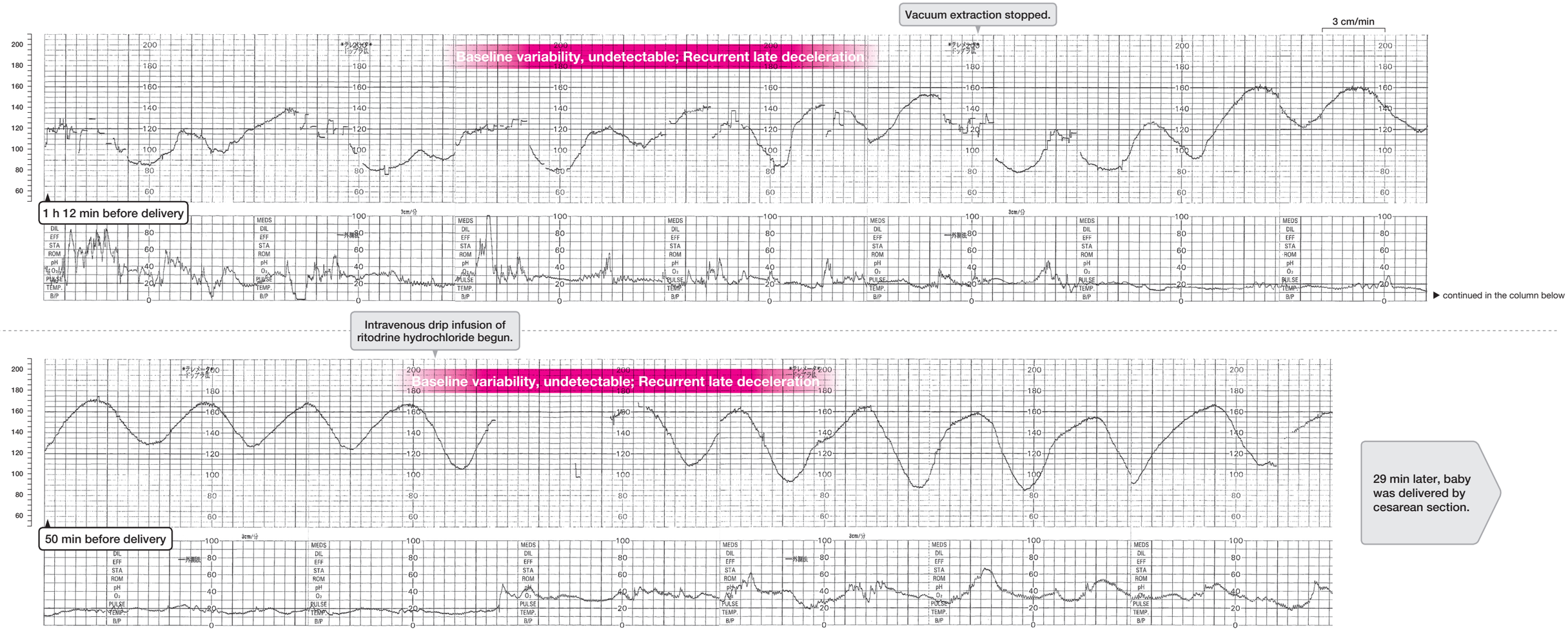


Findings associated with delivery

- Umbilical venous pH was 6.7 level.
- Newborn course:
  Apgar score; 4 at 1 min
  4 at 5 min
- Operative findings:
  Malrotation (occiput posterior position of the vertex)
- Findings of the amniotic fluid, umbilical cord, and placenta:
  Bloody amniotic fluid; Clots; Calcium deposits; White placental infarction
  Histopathological examination ▶ Placental infarction

- Causes of the development of cerebral palsy in the cause analysis report
  Unknown or unspecified causes

Case 43 (Others)

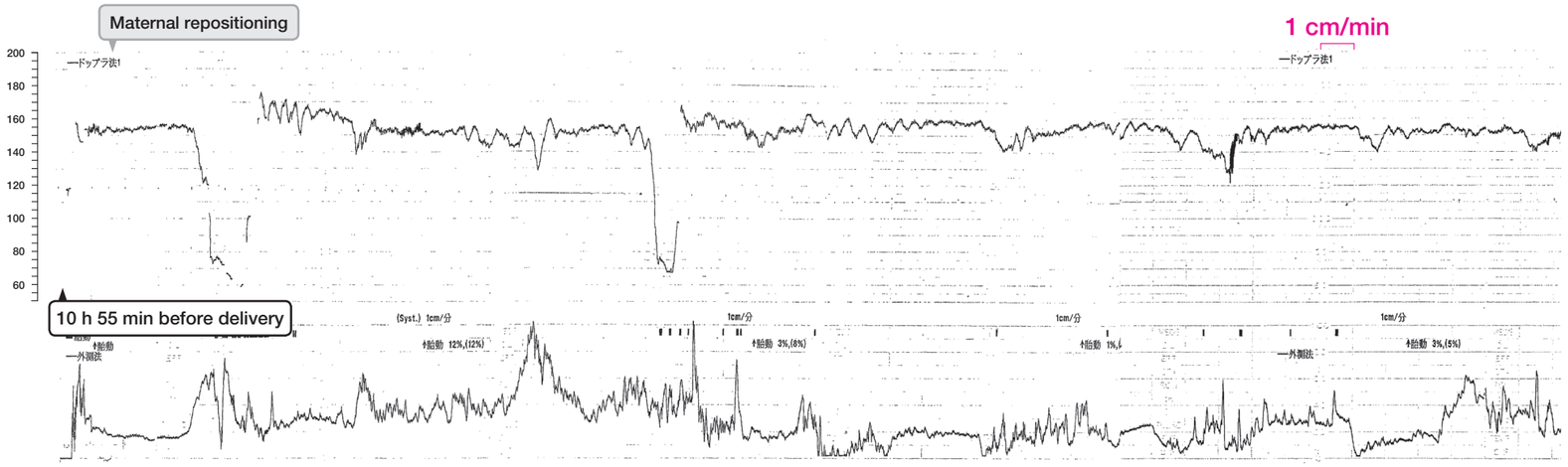
Summary

Gestational weeks 39 weeks' gestation **Risk factors** GBS colonization; Bacterial vaginitis; Endocervicitis; Threatened preterm delivery **Birth weight** 2600 g level

Delivery course The woman was admitted to hospital because of labor pains. ▶ Cesarean section was performed based on the diagnosis of non-reassuring fetal status and prolonged labor.

On admission

10 h 57 min before delivery
Cervical dilatation 1.5 cm
She noted labor pains every five min.

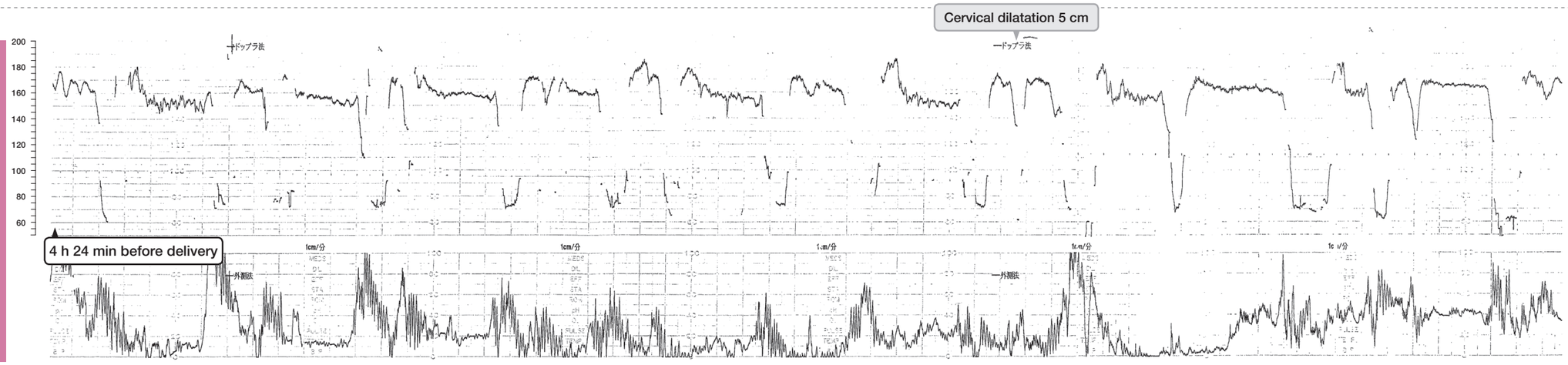


Cautions in interpretation

Since the paper speed of the cardiotocograph was 1 cm/min, it is difficult to interpret the presence or absence of baseline variability and deceleration patterns.

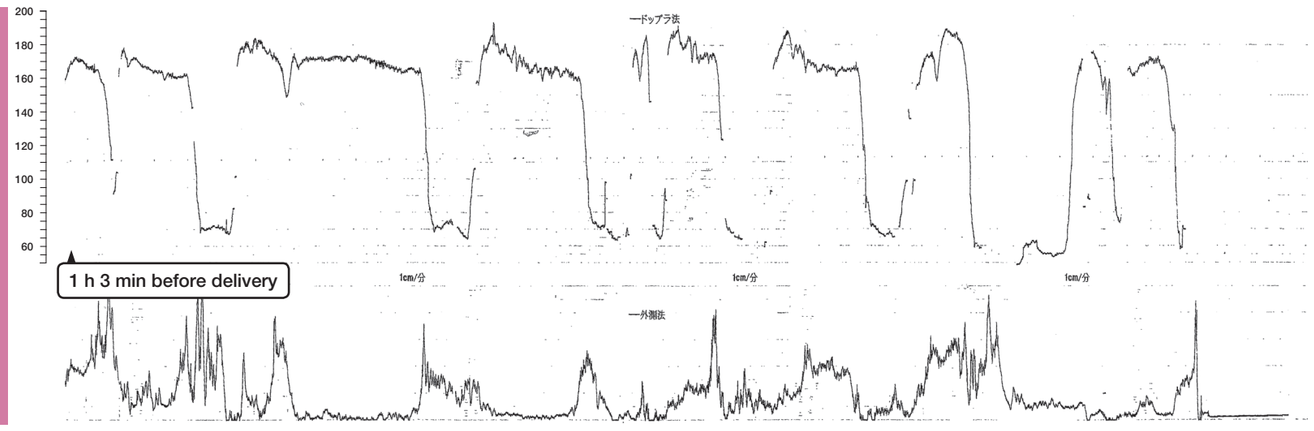
5 h 17 min before delivery
Cervical dilatation 3-4 cm
Oxygen supplementation begun.

During hospitalization



2 h 2 min before delivery
No abnormalities in the placenta or rotation of the fetal head were detected on ultrasonography.
Cervical dilatation 5 cm

Before delivery



27 min later, baby was delivered by cesarean section.

Findings associated with delivery

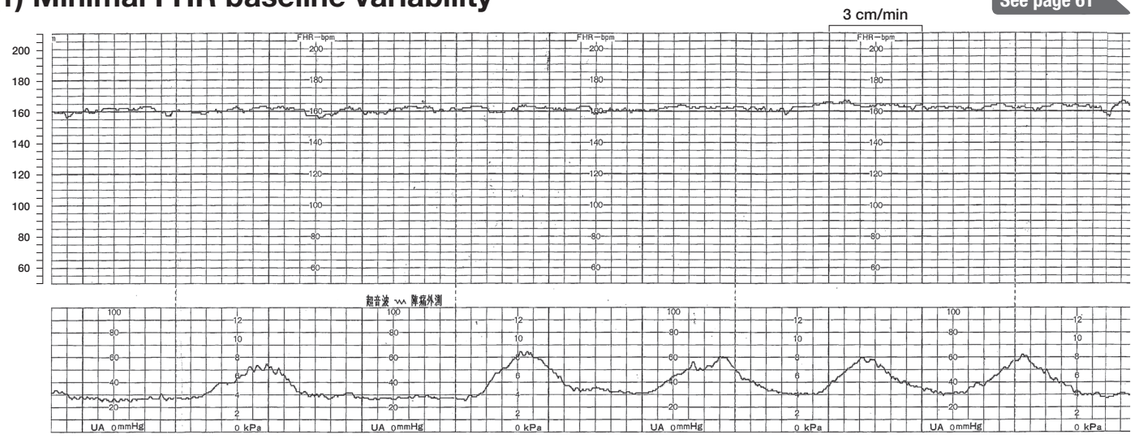
- Umbilical artery pH was 7.0 level
- Newborn course:
  Apgar score; 1 at 1 min
  1 at 5 min
- Findings of the amniotic fluid, umbilical cord, and placenta:
  Meconium staining; Marginal or velamentous insertion of the cord
  Histopathological examination ▶ Chorioamnionitis

- Causes of the development of cerebral palsy in the cause analysis report
  Multiple factors (prolonged labor, Umbilical cord complications, excluding umbilical cord prolapse, and chorioamnionitis)

2. FHR patterns to be interpreted with caution

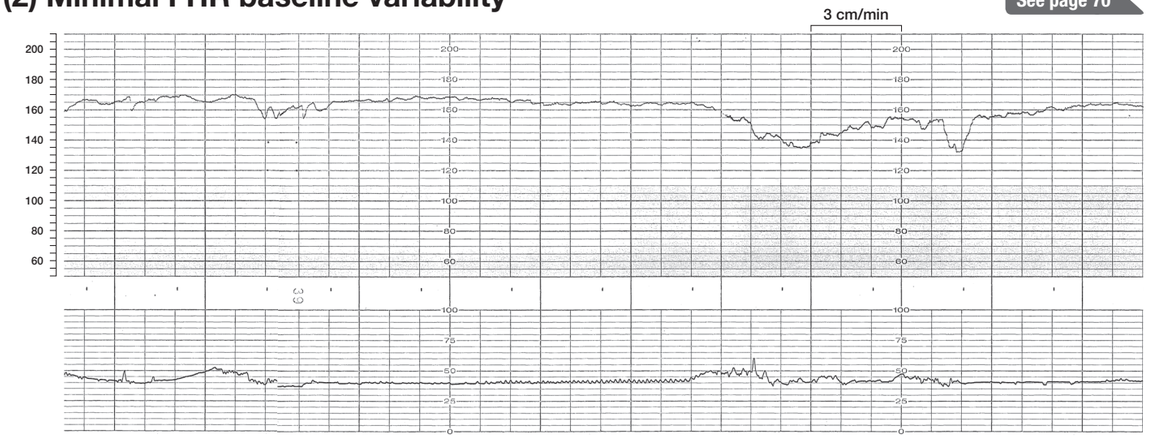
(1) Minimal FHR baseline variability

See page 61



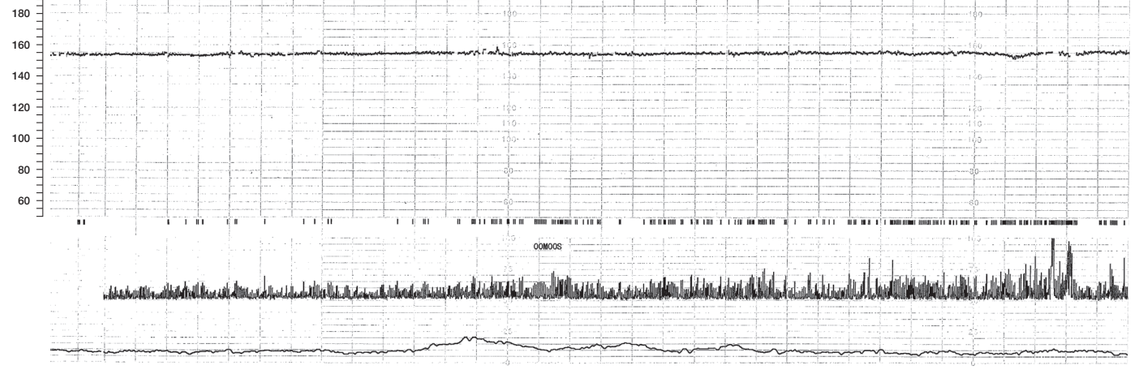
(2) Minimal FHR baseline variability

See page 70



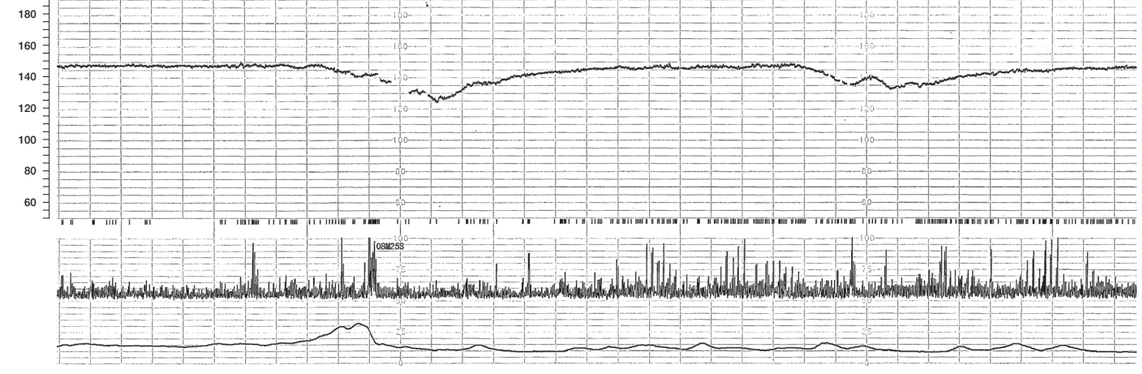
(3) Undetectable FHR baseline variability

See page 67

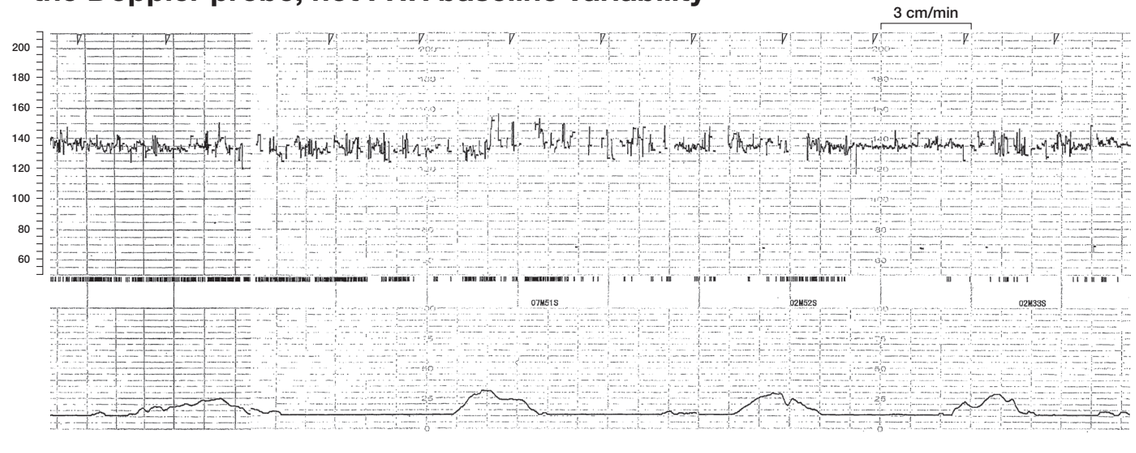


(4) Undetectable FHR baseline variability

See page 41

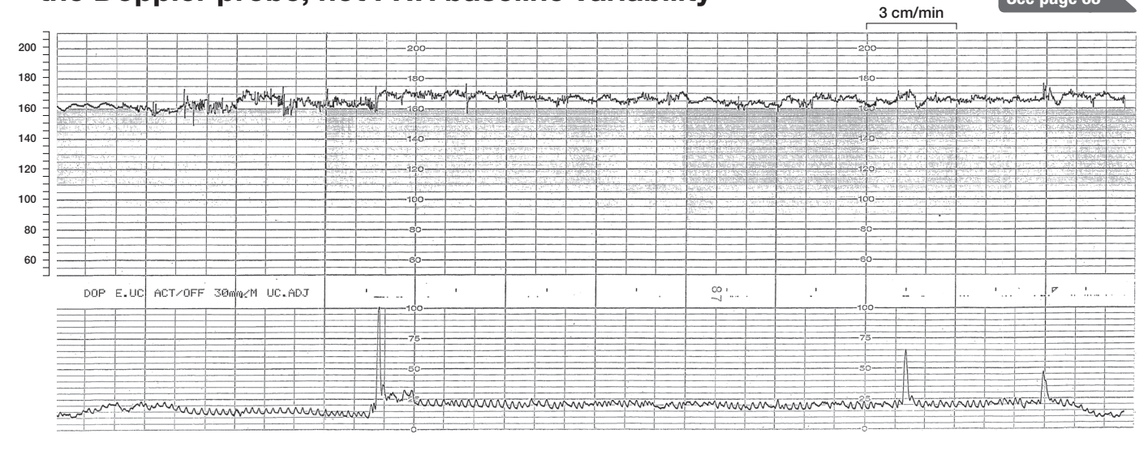


(5) Noises attributable to an inappropriate placement of the Doppler probe, not FHR baseline variability



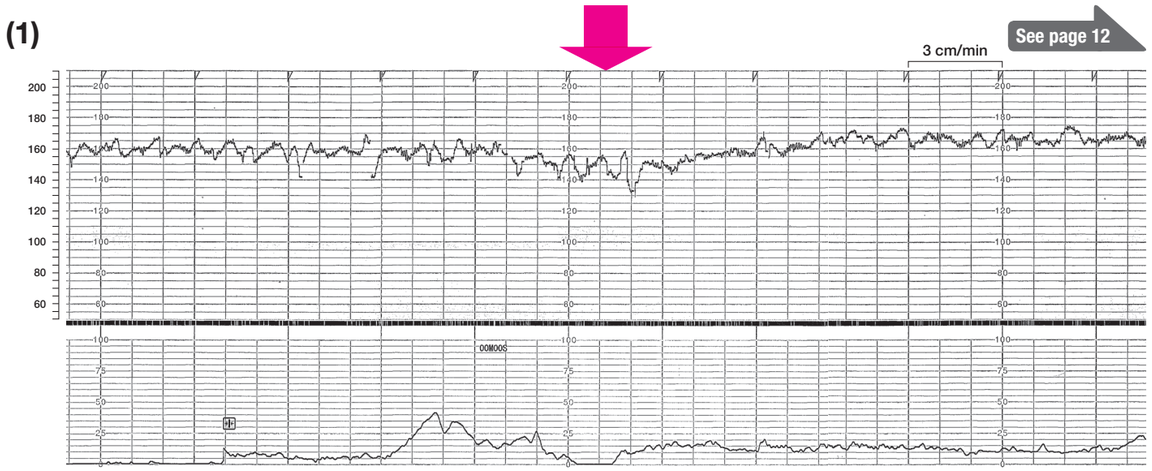
(6) Noises attributable to an inappropriate placement of the Doppler probe, not FHR baseline variability

See page 63



(1)～(5): There is concern about overlooking the late decelerations because of only a modest decrease of the FHR.

(1)



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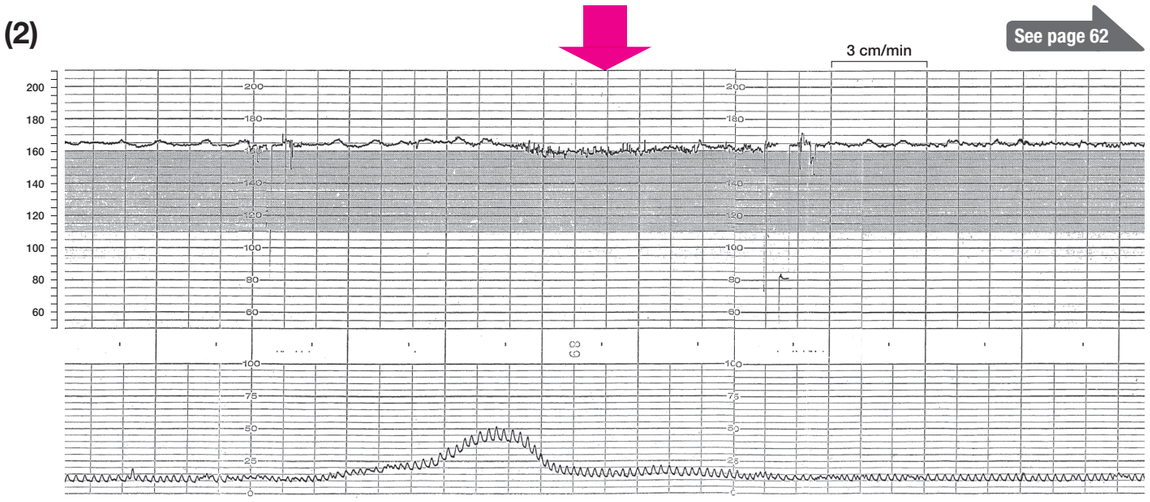

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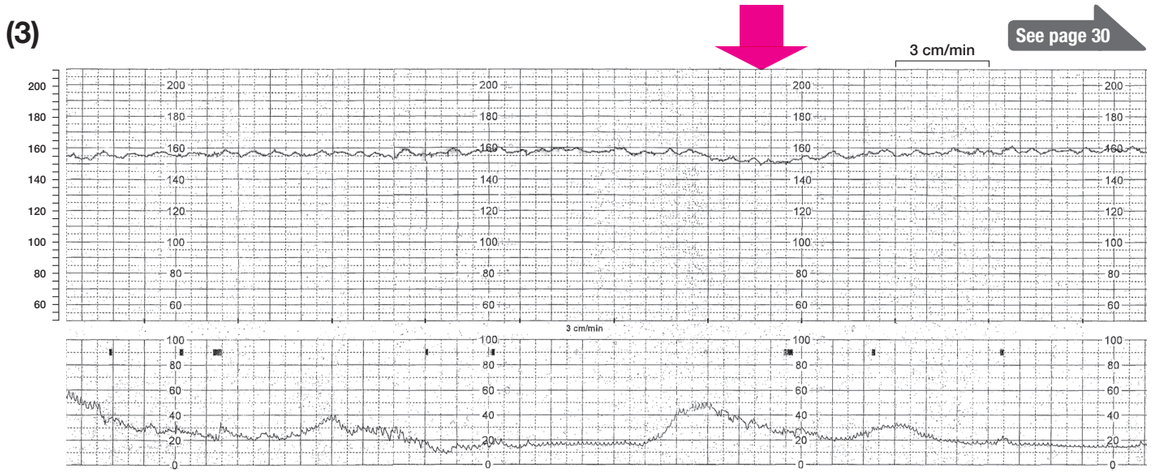

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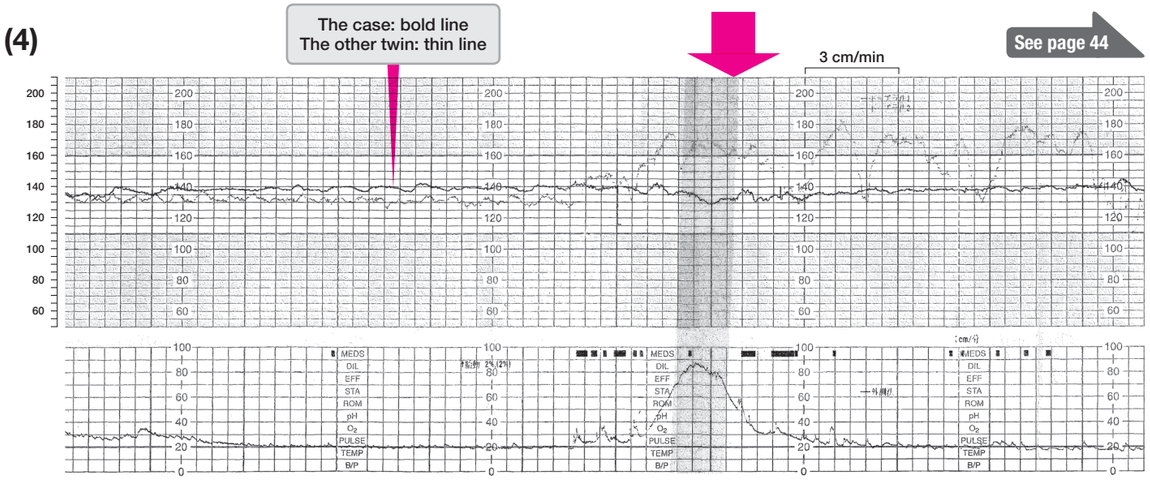
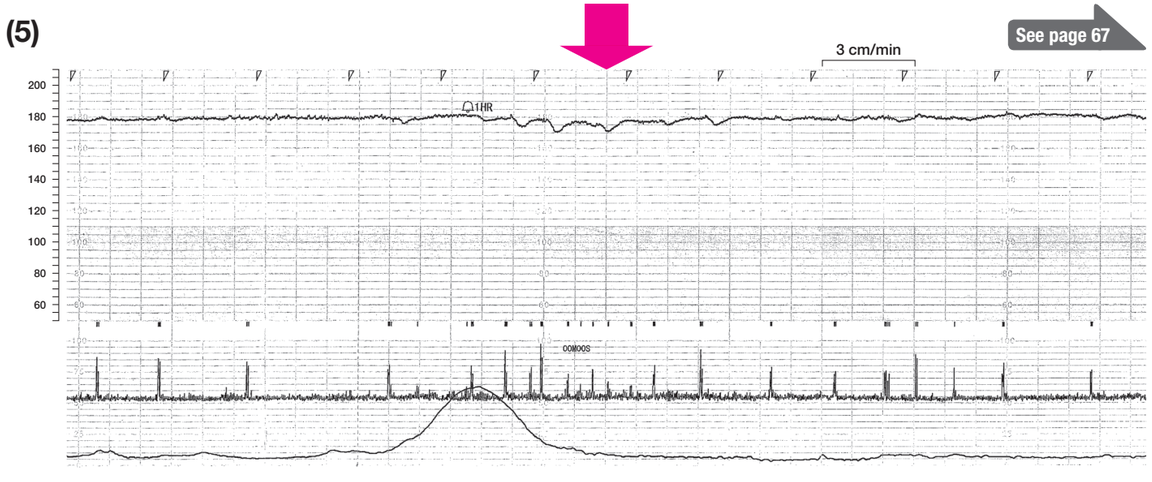


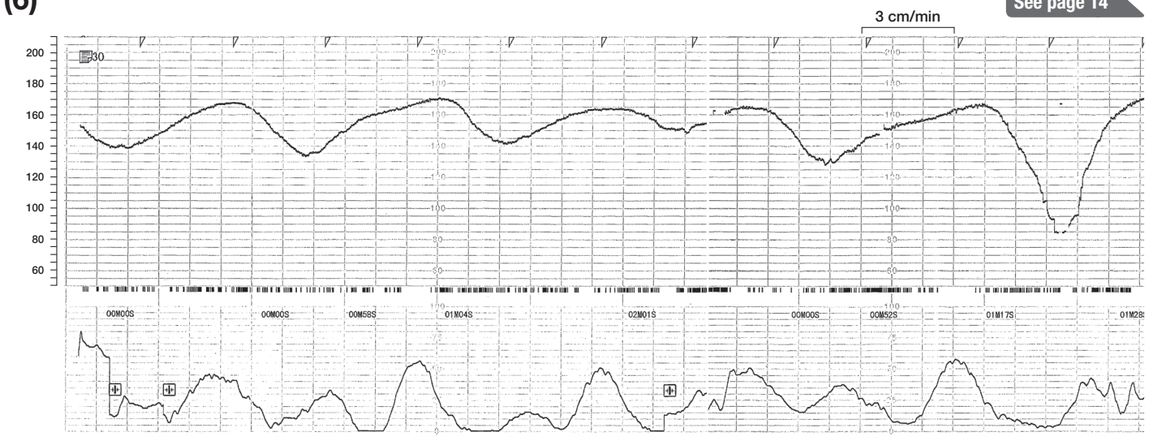
(5)



(6)～(10): There is concern about interpreting them as accelerations by misreading the FHR baseline despite the occurrence of recurrent late decelerations.

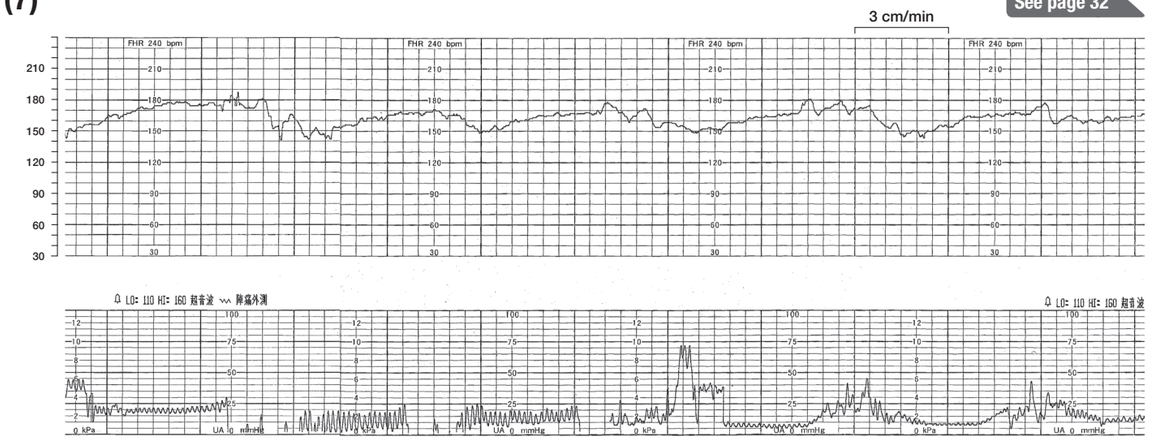
(6)

See page 14



(7)

See page 32



(8)

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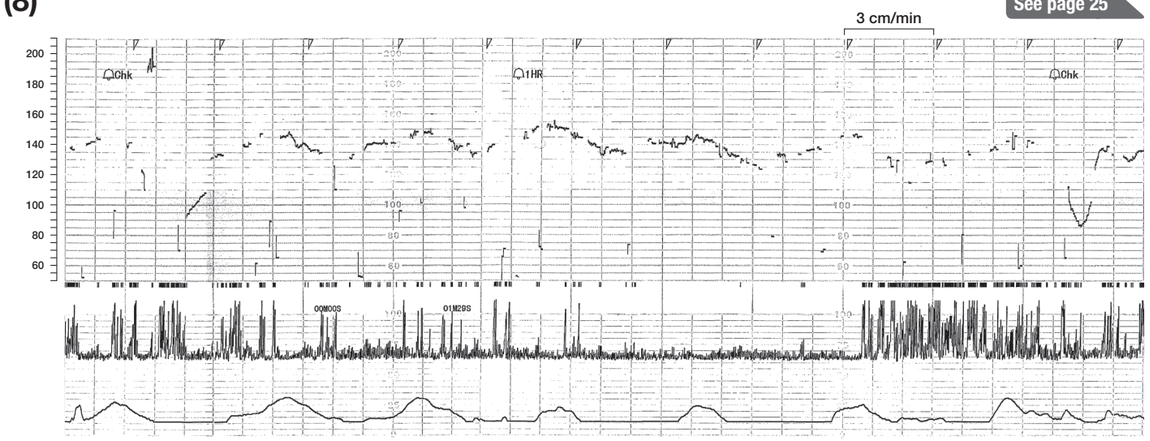
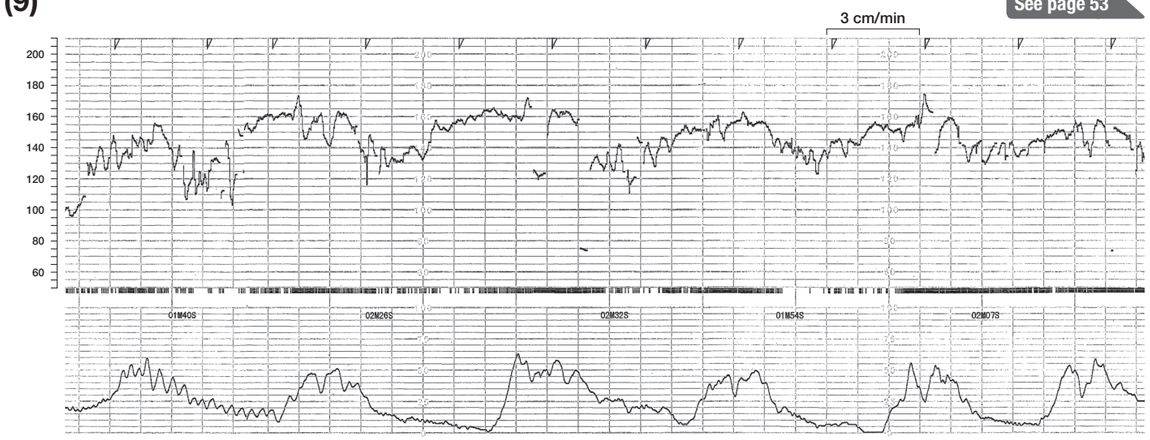


(9)

See page 53



(10)

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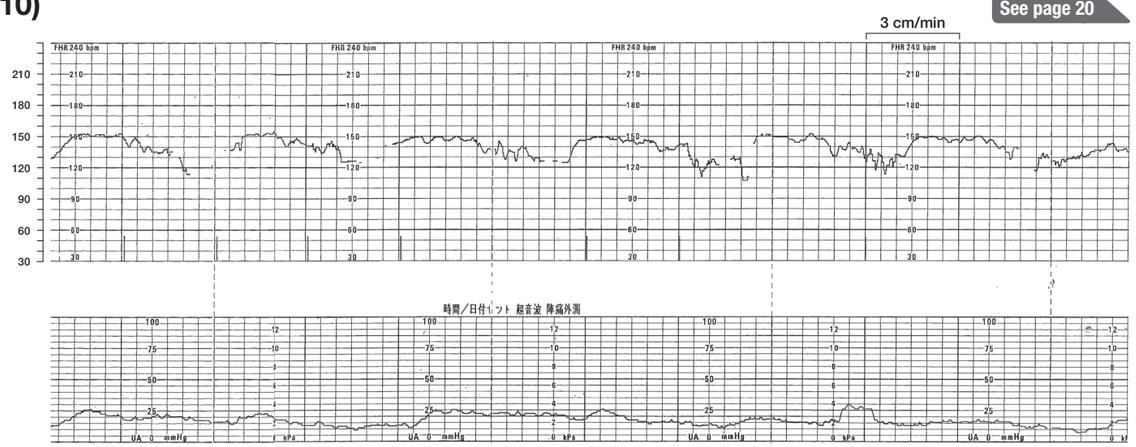
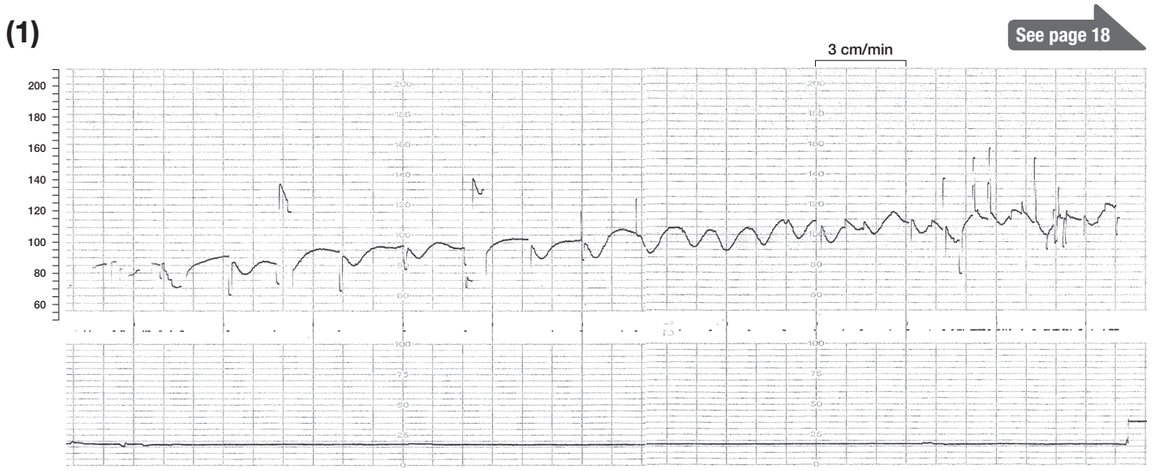


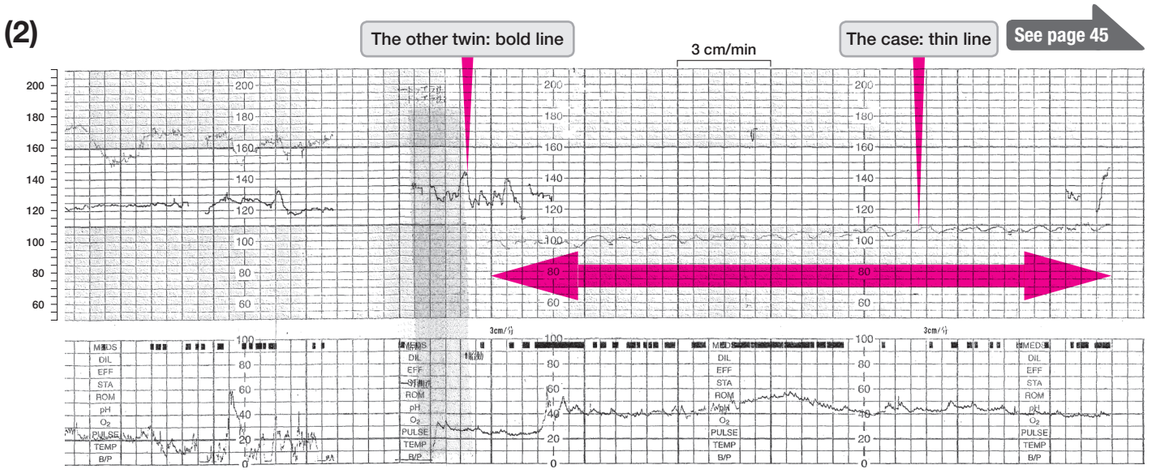
3) Interpretation of the sinusoidal pattern

(1)



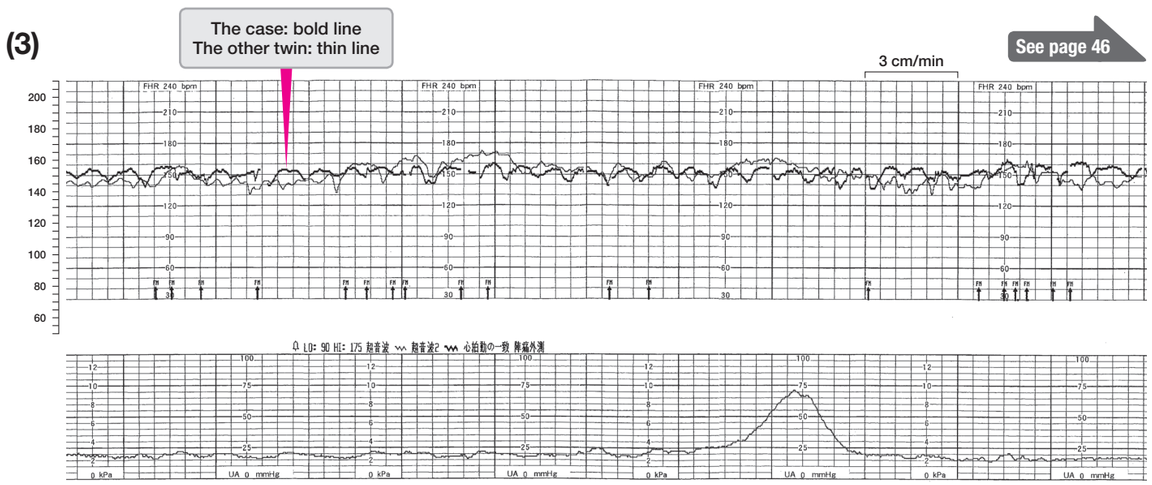
See page 18

(2)



See page 45

(3)



See page 46

Resource Materials

Terms and definitions used in relation to FHR monitoring

(Report from the subcommittee for terms and definitions used in relation to FHR monitoring,
Perinatology Committee of the Japan Society of Obstetrics and Gynecology, 2003)

Terminology of fetal heart rate (FHR) monitoring

A. FHR baseline

1) Normocardia: 110 to 160 bpm
2) Bradycardia: Less than 110 bpm
3) Tachycardia: Greater than 160 bpm

B. FHR baseline variability

C. FHR variability

D. Periodic or episodic change of FHR

(1) Acceleration
(2) Deceleration
(i) Early deceleration
(ii) Late deceleration
(iii) Variable deceleration
(iv) Prolonged deceleration

Definitions of FHR patterns

A. FHR baseline

As FHR baseline, the mean fetal heart rate is rounded to increments of 5 beats per minute during a 10 minute segment.

Note: FHR baselines are expressed as increments of 5 beats (ex., 150 bpm for 152 bpm, 140 bpm for 139 bpm).

For interpretation, the following parts are excluded:

1. periodic or episodic change
2. FHR baseline variability segments that differ by more than 25 bpm And
3. When multiple baselines are present in a 10-minute window and they differ by more than 25 bpm, the baseline for that period is not determined.

The baseline must be for a minimum of 2 min in any 10-minute segment. Otherwise, the baseline for that time period is indeterminate. In this case, review of the previous 10 minute segments should be the basis for determination of baseline.

When a FHR baseline is less than 110 bpm, it is called bradycardia. When a FHR baseline is over 160 bpm, it is called tachycardia.

B. FHR baseline variability

FHR baseline variability is defined as fluctuations with at least 2 cycles per minute in the fetal heart rate baseline that are irregular in amplitude and frequency. Sinusoidal patterns are excluded from this variability category.

Baseline variability is quantitated as the amplitude of peak-to-trough in bpm using the following four amplitude ranges:

1. Undetectable: Amplitude range undetectable
2. Minimal: Amplitude range detectable but 5 bpm or fewer
3. Moderate: Amplitude range 6-25 bpm
4. Marked: Amplitude range greater than 25 bpm

Variability should be visually quantitated. The terminology of short term variability and long term variability are not used.

(Note) Sinusoidal pattern

A sinusoidal pattern is defined as a smooth, regular sine wave-like pattern in FHR baseline with any duration. Its cycle frequency is 2 to 6 per minute. Its amplitude is 5 to 15 bpm on average (maximum, 35bpm).

* The following items were added to the above definition of a sinusoidal pattern in the “2010 Intrapartum management guidelines based on fetal heart rate pattern classification.”

(1) persists for 10 min or more
(2) A smooth, sine wave is a pattern in which a short term variability is lost or significantly decreased.
(3) not accompanied by accelerations

C. FHR variability

In the necessity to determine FHR variability in the segments other than FHR baseline segments, the above four definitions are to be applied.

D. Periodic or episodic change of FHR

(1) Acceleration

An acceleration is defined as an abrupt increase of at least 15 bpm in FHR above the baseline. Onset to peak is less than 30 seconds and the duration is equal to or more than 15 seconds and less than 2 min from onset to return. At less than 32 weeks’ gestation, an acceleration is defined as an increase of 10 bpm or more above baseline which lasts for 10 seconds or more.

Prolonged acceleration

An acceleration is classified as a prolonged acceleration if the duration is 2 min or more but less than 10 min. An acceleration that lasts 10 min or more is considered a baseline change.

(2) Deceleration

* The following items were added to the definition of decelerations in the "Proposed revision: terminology and definitions for cardiotocograms (June 2013)."
Deceleration patterns are classified based on visual assessment regarding an abrupt or gradual decrease in FHR. If it is difficult to determine the classification, set threshold value of 30 seconds against a time from onset of the decrease in FHR to nadir for differentiation. When associated with uterine contractions, decelerations are classified into four patterns below. Even when not associated with uterine contractions, variable decelerations and prolonged decelerations should be determined.

(i) Early deceleration

An early deceleration is defined as a gradual decrease in FHR and return to baseline associated with a uterine contraction. Onset to nadir of an early deceleration is equal to or greater than 30 seconds and the nadir occurs at the same time as the peak of the contraction. The decrease in FHR is calculated from the FHR measured just before the onset.

* The definition of an early deceleration was corrected in the "Proposed revision: terminology and definitions for cardiotocograms (June 2013)" as follows.
An early deceleration is defined as a gradual decrease in FHR and return to baseline associated with uterine contractions. The nadir of the deceleration usually occurs at almost the same time of the peak of the contraction.

(ii) Late deceleration

A late deceleration is defined as a gradual decrease in FHR and return to baseline associated with a uterine contraction. Onset to nadir of a late deceleration is equal to or greater than 30 seconds and the nadir occurs after the peak of the contraction. The decrease in FHR is calculated from the FHR measured just before the onset.
(Note) In most cases, the onset, nadir and recovery of the deceleration occur after the beginning, peak and ending of the contraction, respectively.

* The definition of a late deceleration was corrected in the "Proposed revision: terminology and definitions for cardiotocograms (June 2013)" as follows.
A late deceleration is defined as a gradual decrease in FHR and return to baseline associated with uterine contractions. The nadir of the deceleration occurs after the peak of the contraction. In most cases, the onset, nadir and recovery of the deceleration occur after the beginning, peak and ending of the contraction, respectively.

(iii) Variable deceleration

A variable deceleration is defined as an abrupt decrease in FHR by 15 bpm or greater. Onset to the beginning of the FHR nadir is less than 30 seconds. The decrease in FHR lasts for 15 seconds or more and less than 2 min in duration from onset to return to baseline. When variable decelerations occur in conjunction with uterine contractions, the waveform, depth and duration vary with each uterine contraction.

(Note) When uterine contractions are unclear, a classification of the deceleration (e.g., an early, late or variable deceleration) is not distinguished.

* The definition of a variable deceleration was corrected in the "Proposed revision: terminology and definitions for cardiotocograms (June 2013)" as follows.
A variable deceleration is defined as an abrupt decrease in FHR by 15 bpm or more that lasts 15 seconds or more, but less than 2 min in duration from onset to return to baseline. The decrease in FHR is calculated from the FHR measured just before the onset. When variable decelerations occur in conjunction with uterine contractions, the waveform, degree of decline and duration often vary with each uterine contraction.

(iv) Prolonged deceleration

A prolonged deceleration is defined as a decrease in FHR by 15 bpm or more that lasts for at least 2 min but less than 10 min from onset to return to baseline. A deceleration that is sustained for 10 min or more is a baseline change.

* The definition of a prolonged deceleration was corrected in the "Proposed revision: terminology and definitions for cardiotocograms (June 2013)" as follows.
A prolonged deceleration is defined as a decrease in FHR by 15 bpm or more that lasts for at least 2 min but less than 10 min from onset to return to baseline. The decrease in FHR is calculated from the FHR measured just before the onset. A prolonged deceleration that is sustained for 10 min or more is a baseline change.

References

1. Report from the subcommittee for terms and definitions used in relation to FHR monitoring. Subcommittee for terms and definitions used in relation to FHR monitoring, Perinatology Committee of the Japan Society of Obstetrics and Gynecology (JSOG). Acta Obstetrica et Gynaecologica Japonica 2003; 55:1205-1216
2. Intrapartum management guidelines based on fetal heart rate pattern classification (2010). Subcommittee for the development and the validation of diagnostic criteria for non-reassuring fetal status, Perinatology Committee of the Japan Society of Obstetrics and Gynecology (JSOG). Acta Obstetrica et Gynaecologica Japonica 2010; 62:2068-2073
3. Proposed revision: Terminology and definitions of fetal heart rate (FHR) monitoring. Subcommittee for the validation of the diagnostic criteria for non-reassuring fetal status, Perinatology Committee of the Japan Society of Obstetrics and Gynecology (JSOG). Acta Obstetrica et Gynaecologica Japonica 2013; 65:1398

Closing remarks

Public Interest Incorporated Foundation Japan Council for Quality Health Care
Executive Managing Director, The Japan Obstetric Compensation System for Cerebral Palsy, **Shigeru Ueda**

In addition to providing prompt compensation for those children diagnosed as having severe cerebral palsy that developed in relation to delivery and their families, the Japan Obstetric Compensation System for Cerebral Palsy, inaugurated in January 2009, also contributes to dispute prevention, early resolution of disputes, and improvement of obstetric health-care quality by providing information contributing to the prevention of recurrence of similar cases through analysis of the causes of development of cerebral palsy.

The system performs cause analysis of compensated cases to clarify the causes of cerebral palsy that developed in relation to delivery and proposes measures for preventing recurrence of similar cases, without trying to pin responsibility. All compensated cases are subject to cause analysis and the results, including the causes of cerebral palsy that developed in relation to delivery, medical assessment of the clinical course and issues to be considered for improvement of the quality of obstetric care are prepared as the “cause analysis report.”

Compensation is provided according to the following criteria: birth weight more than 2,000 grams and pregnancy longer than 33 weeks, or pregnancy longer than 28 weeks and birth under hypoxic conditions conforming to prespecified criteria; however, almost all cases of cerebral palsy are collected in this system and the information accumulated by this system is considered to be extremely precious to providers of obstetric care around the world.

It is important that cardiotocogram submitted by birthing facilities are used for the education and research activities of obstetric care providers to prevent recurrence and improve obstetric care quality. We published this educational material presenting Cardiotocograms of Cerebral Palsy Cases in Japanese in January 2014.

We have recently prepared the English version of this educational material with the hope of contributing to prevention of recurrence and improvement of obstetric care quality around the world, just as in Japan, because this educational material provides very useful information for obstetric care providers. We sincerely hope for a larger readership of this book.

I am grateful to the eight members of the FHR Monitoring Working Group, including the committee chairperson, Dr. Hiroshi Sameshima, Professor, Department of Obstetrics and Gynecology, University of Miyazaki, Faculty of Medicine, for their enormous contribution to the compilation of this educational material. I am also grateful to Dr. Nobutsugu Hanada, a guest researcher of the Japan Council for Quality Health Care, for his help in preparing the English version of this educational material.

The contents of this book are based on the information and opinions available to the experts at the time of the preparation of this book. We took all possible measures to ensure the accuracy at the time of the preparation of the book; however, we cannot offer assurance as to the contents in the years to come. Hence, this book should be used at the voluntary discretion or choice of the person on his/her own responsibility. The JCQHC cannot accept any responsibility whatever for the practices of the users of this book. Moreover, JCQHC cannot limit the discretion of health care providers or assign duty or responsibility to them.

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Cardiotocograms of Cerebral Palsy Cases
Interpretations and considerations of FHR patterns

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