Relationship Between Advanced Maternal Age, Hiesho (Sensitivity to Cold) and Abnormal Delivery in Japan

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Abstract: *Background*: In Japan, the proportion of women aged 35 and older giving birth has greatly increased in recent years, and maternal age is continuing to increase. Advanced maternal age is a risk factor for abnormal delivery, as is *hiesho* (sensitivity to cold).

Research Question: This study aimed to assess whether advanced maternal age and *hiesho* precipitate premature delivery, premature rupture of membranes, weak labor pains, prolonged labor and atonic bleeding.

Method: The study design was a descriptive comparative study with a retrospective cohort group design. Subjects in this study were 2,810 Japanese women in hospital after childbirth. The research methods employed were a paper questionnaire and extraction of data from medical records.

Results: Comparing the rate of occurrence of abnormal delivery among women aged 35 to 39 according to whether or not they had hiesho, results were premature delivery OR: 3.51 (95% CI: 1.66-7.43), premature rupture of membranes OR: 1.25 (95% CI: 0.90-1.74), weak labor pains OR: 2.94 (95% CI: 1.65-5.24), prolonged labor OR: 2.56 (95% CI: 1.23-5.26), and atonic bleeding, OR: 1.65 (95% CI: 0.14-2.40) when hiesho was present. Among women aged 40 and over, results were premature delivery OR: 5.09 (95% CI: 1.16-22.20), premature rupture of membranes OR: 1.60 (95% CI: 0.73-3.46), weak labor pains OR: 7.02 (95% CI: 1.56-31.55), prolonged labor OR:7.19 (95% CI: 1.49-34.60) and atonic bleeding OR: 2.00 (95% CI: 0.64-6.23).

Conclusions: Regardless of maternal age, the presence of hiesho is a risk factor that can precipitate premature delivery, premature rupture of membranes, weak labor pains, prolonged labor and atonic bleeding. Furthermore, hiesho coupled with advanced maternal age increases the incidence of premature delivery, weak labor pains and prolonged labor.

Keywords: Maternal age, abnormal delivery, hiesho.

INTRODUCTION

Demographic change—population aging and a declining birthrate— is continuing unabated in Japan. It is also widely known that there are increased risks in childbirth at an advanced maternal age, and in perinatal health care, the Japan Society of Obstetrics and Gynecology defines childbirth by primipara aged 35 and over as first childbirth at an advanced maternal age and states that first births at an advanced maternal age are a risk factor at the time of delivery. Guidelines for perinatal health care for 2010 also call for careful management of first births at an advanced maternal age [1].

In Japan, hiesho is a condition that the general public is quite well acquainted with, and some sources claim that over 60 percent of Japanese women suffer from hiesho [2]. Birthing centers also actively offer care for relieving hiesho

among mothers. But although considerable attention is paid to hiesho in Japan, there are few papers on the topic and evidence is scant.

As for the pathology of hiesho, the condition occurs when the balance of the autonomic nervous system, which controls the sympathetic nervous system and the parasympathetic nervous system, is upset and the sympathetic nervous system becomes dominant. To maintain core temperature, the peripheral blood vessels contract, impairing circulation and making the sufferer sensitive to cold. Thus hiesho is a state in which the peripheral temperature is low even though core temperature is not low [3].

But definitions of hiesho are vague. Using the concept analysis approach of Rodgers *et al.* (2000), we conducted a concept analysis of hiesho and defined it as "the presence of a difference between core and peripheral temperatures and a pathology wherein peripheral temperature is slow to recover, even in a warm environment, and where in many cases the subject is sensitive to cold [4]".

Meanwhile, we reported on the relationship between hiesho in mothers and abnormal delivery as a risk factor in

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abnormal delivery [5, 6]. Our findings for the 2,810 women studied were that premature delivery was 4 times more likely among mothers with hiesho than those with no hiesho, and that premature rupture of membranes was 1.7 times more likely among the former, indicating that hiesho is a risk factor for abnormal delivery. In other words, hiesho appears to be a risk factor for abnormal delivery.

As far as the relationship between older maternal age and abnormal delivery is concerned, Cnattingius *et al.* [7] report that compared to mothers under age 35, the rate of premature birth before the 32nd week is 1.7 times higher among mothers aged 35-39 and 2.2 times higher among mothers aged 40 and over, indicating an increase in premature births among older mothers. Hirano [8] holds that older mothers have higher rates of weak labor pains and prolonged labor. In other words, older maternal age is a risk factor for abnormal delivery.

Accordingly, older maternal age, which is an increasingly prevalent issue, and hiesho are risk factors for abnormal delivery, but there does not appear to be any research on the relationship among older maternal age, hiesho and abnormal delivery. As we have thus seen, advanced maternal age at childbirth and hiesho are issues, but is there a relationship between advanced maternal age, hiesho and abnormal delivery? The aim of this research is to analyze the impact of advanced maternal age on hiesho, premature delivery, premature rupture of membranes, weak labor pains, prolonged labor and atonic bleeding.

METHOD

Design

The study design was a descriptive comparative study with a retrospective cohort group design.

Subjects of Study

Subjects in this study were 2,810 women in hospital after childbirth.

When delivery is uneventful, new mothers are usually kept in hospital for approximately 5 days; data for this study was collected during this time.

Criteria for the study were that subjects be Japanese women (holders of Japanese nationality) residing in Japan for 1 or more years prior to the birth; women who had experienced a stillbirth or neonatal death were excluded.

Study Setting

The study was conducted over the 12-month period from October 19, 2009 to October 8, 2010. Taking into account the impact of the seasons on hiesho, the study period was set at 1 year.

The study was conducted at 6 cooperating hospitals with obstetrics and pediatric departments in Tokyo, Japan. The definitions for various abnormalities at delivery are those adopted by the Japan Society of Obstetrics and Gynecology.

The standards used as the basis for diagnosing an abnormality at delivery were the same as the operational definition of terms at all 6 institutions surveyed. Methods for measuring blood loss at delivery, etc. were also generally uniform.

Actual Study

The aim of the study was explained to women in hospital after childbirth, and those who agreed to cooperate with the study were asked to fill out a self-administered questionnaire. Completed questionnaires were retrieved by methods chosen in accordance with hospital policy or respondents' circumstances, such as by placing them in a retrieval box, etc.

The questionnaires were delivered to the researchers, who extracted information about the delivery of the cooperating respondents from their medical records (delivery logs or midwife logs). Respondents who changed their minds about cooperating were asked to return a form for withdrawing cooperation with the study distributed to them beforehand to a specified address, by postal mail or fax.

Instrument

The research collected data from self-administered questionnaires and medical records. The questionnaire created by the researchers covered 31 items, including presence or absence of hiesho, age, history of previous births, presence or absence of complications and so forth. The main information collected from medical records was about the entire birthing process and about newborns. Data about the birthing process included information about the length of the pregnancy, to ascertain whether the birth was premature; strength of labor pains and whether an ecbolic was used; length of labor, to check for weak labor pains or prolonged labor; timing of rupture of the membranes, to determine whether this occurred early; blood loss at delivery, to determine whether there was atonic bleeding; and other items related to diagnosing such conditions or items relating to abnormal delivery. Information about newborns covered number of babies born, birth weight and Apgar score. The questionnaire was carefully checked to ensure appropriateness in terms of both content and surface.

The survey was a paper questionnaire which subjects were free to fill in as they wished, and submittal of answers to the questionnaire was deemed to imply consent on the part of the subjects.

Operational Definition of Terms

The operational definition of terms in this research was as follows:

Premature delivery: delivery after the 22nd week and before the 37th week of pregnancy [9].

Premature rupture of membranes: rupture of the membranes before the onset of labor [9].

Weak labor pains: when medical personnel at the institution where the subject gave birth judge that labor is not progressing, due to insufficient uterine contractions [9].

Prolonged labor: when birth has not occurred after 30 hours (in the case of a primipara) or 15 hours (in the case of a multipara) from the onset of labor (i.e. when contractions are occurring at less than 10 min. intervals, as determined by medical personnel) [9].

Atonic bleeding: bleeding involving blood loss of over 500ml up to 2 hours after delivery, from blood vessels open in the placenta detached area which fail to constrict within

the uterine muscle layer due to insufficient contraction of the uterine muscle after fetus and placenta have been expelled [10].

Hiesho: based on prior research, hiesho is defined as a condition where the subject is aware of being sensitive to cold, because awareness of sensitivity to cold reflects the objective index of temperature difference [2], based on the fact that the differences in forehead deep body temperature and sole deep body temperature are 5.2° C among subjects aware of being sensitive to cold and 2.4 °C among subjects not aware of being sensitive to cold, with a significant difference being observed between the two groups. Specifically, this refers to subjects who replied in the questionnaire that they were sensitive to cold or had cold hands and feet in the latter half of pregnancy. To take into account the fact that this research includes premature deliveries and thus that the length of the latter half of pregnancy differs, the number of weeks in the latter half of respondents' pregnancies is not defined.

Data Analyses

The statistics software SPSS Statistics 19.0 was used to carry out statistical analysis and to analyze the incidence rate of abnormalities at delivery among women under the age of 35, women aged 35 to 39, and women aged 40 and over with and without hiesho. The reason why the groups were divided thus is that the International Federation of Gynecology and Obstetrics (FIGO) defines older mothers as primipara aged 35 and over and multipara aged 40 and over, and because in this study there is a strong likelihood of abnormal delivery among mothers aged 35 and over and particularly among those aged 40 and over [11]. The older mothers were further divided into two groups and data were compared and analyzed for three groups: those under 35, those aged 35-39, and those aged 40 and over.

The analysis method was multiple logistic regression analysis. In the analysis, dependent variables were analyzed for each type of abnormal delivery and independent variables were analyzed as confounding factors and hiesho. The forced entry method was used for the analysis. Appropriateness of the model was also evaluated.

The hypothesis is that "compared to mothers under age 35, the rate of abnormal delivery due to hiesho is higher among mothers aged 35 and over".

Ethical Considerations

Ethical considerations were fully taken into account in conducting this study. The study was approved by the Ethics Committee of St. Luke's College of Nursing (No. 09-057, September 24, 2009).

RESULTS

Subjects recruited for this research totalled 4,448 women, of whom 2,821 responded. This pool of 2,821 respondents included 3 non-Japanese and 8 individuals who refused permission to access their medical records: those11 women were excluded, and analysis was conducted among a total of 2,810 women. The retrieval rate was 60.8% and the valid response rate was 99.6%.

Background of Subjects (Table 1)

The subjects of the study were 2,810 women.

The ages of the subjects ranged from 16 to 45 and averaged 32.7 years (SD 4.6). By age group, 1,783 (63.5%) were under the age of 35, 870 (31.0%) were aged 35 to 39, and 157 (5.6%) were aged 40 and over.

Regarding presence or absence of hiesho in the latter half of pregnancy, overall, 1,168 (41.6%) out of the 2,810 women reported hiesho, while 1,642 (58.4%) said they did not feel hiesho. For hiesho by age group, 762 women under the age of 35 (42.7%), 346 women aged 35 to 39 (39.8%), and 59 women aged 40 and over (38.2%) reported hiesho; thus, the ratio of occurrence of hiesho was around 40% among all age groups. Regarding complications during pregnancy, 595 women under the age of 35 (33.4%), 413 women aged 35 to 39 (47.5%), and 90 women aged 40 and over (57.3%) developed complications; thus the higher the age of the women, the higher the ratio of occurrence of complications.

The main trouble was uterine fibroids, which occurred in 120 women under the age of 35 (6.7%), 121 women aged 35 to 39 (13.9%), and 27 women aged 40 and over (17.2%).

Comparison of Incidence Rate for Abnormal Deliveries in the Presence or Absence of Hiesho

Premature Delivery (Table 3)

With premature delivery as the dependent variable (response variable) and hiesho and its eleven covariates (Table **2**) as the independent variable (explanatory variable), logistic regression analysis was carried out. The results were: among the 1,783 women under the age of 35, the regression coefficient for hiesho was 1.13, p<0.001 and the odds ratio 3.09 (95% CI:1.72-5.53). Among the 870 women aged 35 to 39, the regression coefficient for hiesho was 1.26, p<0.001 and the odds ratio 3.51 (95% CI:1.66-7.43). Among the 157 women aged 40 and over, the regression coefficient for hiesho was1.63, p=0.03 and the odds ratio 5.09 (95% CI:1.16-22.20). The incidence rate for premature delivery was 5.09 times higher among women with hiesho compared to those without hiesho.

Premature Rupture of Membranes (Table 4)

With premature rupture of membranes as the dependent variable and hiesho and its nine covariates (Table **2**) as the independent variable, logistic regression analysis was carried out. The results were: among the women under the age of 35, the regression coefficient for hiesho was 0.66, p<0.001 and the odds ratio 1.90 (95% CI:1.55-2.43). Among the women aged 35 to 39, the regression coefficient for hiesho was 0.22, p=0.19 and the odds ratio 1.25 (95% CI: 0.90-1.74). Among those aged 40 and over, the regression coefficient for hiesho was 0.47, p=0.24 and the odds ratio 1.60 (95% CI: 0.73-3.49). There was no significant difference for incidence of premature rupture of membranes between the women aged 35 to 39 and those aged 40 and over.

Weak Labor Pains (Table 5)

With weak labor pains as the dependent variable and hiesho and its 16 covariates (Table **2**) as the independent

Table 1.   Demographic Characteristics of Participants N=2810

Age		<35 n=1783	35-39 n=870	40≤ n=157
		n (%)		
Sensitivity to cold (*hiesho*)	Yes	762 (42.7)	346 (39.8)	59 (37.6)
Delivery history	Primipara	1101 (61.7)	341 (39.2)	59 (37.6)
	Multipara	682 (38.3)	529 (60.8)	98 (62.4)
Weight gain (kg) Mean±SD		10.2±3.2	9.8±3.5	9.6±3.9
BMI (kg/m^2) Mean±SD		24.5±2.7	24.5±2.7	24.4±2.5
Smoking (During pregnancy)		66 (3.7)	26 (3.0)	1 (0.6)
Complications	Yes	595 (33.4)	413 (47.5)	90 (57.3)
(Major complications) Uterine fibroids		120 (6.7)	121 (13.9)	27 (17.2)
Ovarian cysts		56 (3.1)	54 (6.2)	19 (12.1)
Infertility		111 (6.2)	144 (16.6)	39 (24.8)
Pregnancy-induced hypertension		34 (1.9)	28 (3.2)	9 (5.7)
Periodontal disease		48 (2.7)	43 (4.9)	11 (7.0)
Hyperthyroidism		25 (1.4)	19 (2.2)	2 (1.3)
Infectious disease		28 (1.6)	6 (0.7)	2 (1.3)
Nephritis		21 (1.2)	8 (0.9)	1 (0.6)
Mode of delivery	Natural delivery	1516 (85.0)	680 (78.2)	114 (72.6)
	Forceps/vacuum delivery	267 (14.9)	31 (3.6)	7 (4.5)
	Caesarean section	188 (10.5)	159 (18.3)	36 (22.9)
Length of time for delivery (h)[*] Mean±SD		9.4±7.2	8.3±7.3	7.9±7.2
Blood loss at delivery(ml)[*] Mean±SD		421.7±286.7	406.9±272.4	429.2±337.1
Premature delivery		63 (3.5)	37 (4.3)	10 (6.4)
Premature rupture of the membrane		429 (24.1)	194 (22.3)	39 (24.8)
Weak labor pains		188 (10.5)	79 (9.1)	21 (13.4)
Prolonged labor		100 (5.6)	43 (4.9)	12 (7.6)
Atonic bleeding[*]		414 (26.0)	173 (24.3)	26 (21.5)
Non-reassuring fetal status[*]		163 (10.2)	49 (6.9)	12 (9.9)
Asphyxia of the newborn[*]		163 (10.2)	49 (6.9)	12 (9.9)

*Analysis excludes respondents who underwent Caesarean sections (n=<35:1,595 mothers, 35-39:711 mothers, 40≤:121 mothers.

variable, logistic regression analysis was carried out. The results were: among the women under the age of 35, the regression coefficient for hiesho was 0.73, p<0.001 and the odds ratio was 2.08 (95% CI:1.44-3.00). For women aged 35 to 39, the regression coefficient for hiesho was 1.08, p<0.001 and the odds ratio 2.94 (95% CI:1.65-5.24). For women aged 40 and over, the regression coefficient for hiesho was 1.95, p=0.01 and the odds ratio 7.02 (95% CI:1.56-31.55). The incidence rate for weak labor pains was 7.02 times higher among women with hiesho compared to those without hiesho.

Prolonged Labor (Table 6)

With prolonged labor as the dependent variable and hiesho and its 16 covariates (Table **2**) as the independent variable, logistic regression analysis was carried out. The results were: among the women under the age of 35, the regression coefficient for hiesho was 1.80, p<0.001 and the odds ratio was 2.24 (95% CI:1.41-3.54). For women aged 35

to 39, the regression coefficient for hiesho was 0.93, p=0.012 and the odds ratio was 2.56 (95% CI:1.23-5.56). For women aged 40 and over, the regression coefficient for hiesho was 1.97, p=0.014 and the odds ratio 7.19 (95% CI:1.49-34.60). The incidence rate for prolonged labor was 7.19 times higher among women with hiesho compared to those without hiesho.

Atonic Bleeding (Table 7)

With atonic bleeding as the dependent variable and hiesho and its 14 covariates (Table **2**) as the independent variable, logistic regression analysis was carried out. Excluding those who had undergone a caesarean section, the sample size was 2,427 women. The results were: among the 1,595 women under the age of 35, the regression coefficient for hiesho was 0.83, p<0.001 and the odds ratio was 2.29 (95% CI:1.80-2.91). For the 711 women aged 35 to 39, the regression coefficient for hiesho was 0.50, p=0.006 and the

Table 2.   Items Selected as Covariates

	Premature Delivery	**Premature Rupture of Membranes**	**Weak Labor Pains**	**Prolonged Labor**	**Atonic Bleeding**
Item	Obstetric history Smoking during pregnancy Ovarian cystoma Infectious diseases Periodontal disease Threatened premature delivery Use of a tocolytic Fetal malformation Congenital fetal anomalies Stress during the latter half of pregnancy Premature rupture of membranes	BMI Obstetric history Smoking during pregnancy Malformation of uterus Infectious diseases Threatened premature delivery Use of a tocolytic Congenital fetal anomalies Premature delivery	BMI Obstetric history Smoking during pregnancy Ovarian cystoma Infectious diseases Hiesho care during labor Stress during the latter half of pregnancy Anxiety during the latter half of pregnancy Gestational age at delivery Use of an ecbolic Premature rupture of membranes Prolonged labor Anomaly of the rotation Giant baby Suspension of delivery Cephalopelvic disproportion	BMI Obstetric history Smoking during pregnancy Infectious diseases Use of a tocolytic Hiesho care during labor Stress during the latter half of pregnancy Anxiety during the latter half of pregnancy Gestational age at delivery Use of an ecbolic Premature rupture of membranes Weak labor pains Anomaly of the rotation Giant baby Suspension of delivery Cephalopelvic disproportion	Obstetric history Smoking during pregnancy Ovarian cystoma Infectious diseases Use of a tocolytic Fatigue in the process of delivery Hiesho care during labor Stress during the latter half of pregnancy Use of an ecbolic Perineal laceration Use of an oxytocic Weak labor pains Prolonged labor Giant baby

Table 3.   Incidence Rate for Premature Delivery in the Presence or Absence of Hiesho by Age Group

Age	Regression Coefficient (B)	Standard Error (SE)	Wald Statistic (SE/B)2	Degrees of Freedom	Significant Probability (p)	Odds Ratio (OR)	95% Confidence Interval (CI Value)
<35*	1.13	0.30	14.36	1	0.001	3.09	1.72-5.53
35-39**	1.26	0.38	10.72	1	0.001	3.51	1.66-7.43
40≤***	1.63	0.75	4.67	1	0.030	5.09	1.16-22.2

Goodness of fit of the model *: Chi-square test p<0.001, Hosmer-Lemeshow test 0.96, discriminant accuracy rate 96.7%.

**: Chi-square test p<0.001, Hosmer-Lemeshow test 0.31, discriminant accuracy rate 95.7%.

***: Chi-square test p=0.036, Hosmer-Lemeshow test 0.94, discriminant accuracy rate 93.6%.

n *=1783, **=870, ***=157.

Table 4.   Incidence Rate for Premature Rupture of Membranes in the Presence or Absence of Hiesho by Age Group

Age	Regression Coefficient (B)	Standard Error (SE)	Wald Statistic (SE/B)2	Degrees of Freedom	Significant Probability (p)	Odds Ratio (OR)	95% Confidence Interval (CI Value)
<35*	0.66	0.12	32.90	1	0.001	1.90	1.55-2.43
35-39**	0.22	0.17	1.73	1	0.19	1.25	0.90-1.74
40≤***	0.47	0.40	1.38	1	0.24	1.60	0.73-3.49

Goodness of fit of the model *: Chi-square test p <0.001, Hosmer-Lemeshow test 0.023, discriminant accuracy rate 75.9%.

**: Chi-square test p =0.011, Hosmer-Lemeshow test 0.744, discriminant accuracy rate 77.8%.

***: Chi-square test p =0.29, Hosmer-Lemeshow test 0.800, discriminant accuracy rate 77.7%.

n *=1783、**=870、***=157.

Table 5.   Incidence Rate for Weak Labor Pains in the Presence or Absence of Hiesho by Age Group

Age	Regression Coefficient (B)	Standard Error (SE)	Wald Statistic (SE/B)2	Degrees of Freedom	Significant Probability (p)	Odds Ratio (OR)	95% Confidence Interval (CI Value)
<35*	0.73	0.19	15.18	1	0.001	2.08	1.44-3.00
35-39**	1.08	0.29	13.45	1	0.001	2.94	1.65-5.24
40≤***	1.95	0.77	6.46	1	0.010	7.02	1.56-31.55

Goodness of fit of the model *: Chi-square test p<0.001, Hosmer-Lemeshow test 0.27, discriminant accuracy rate 90.0%.

**: Chi-square test p<0.001, Hosmer-Lemeshow test 0.52, discriminant accuracy rate 92.0%.

***: Chi-square test p=0.001, Hosmer-Lemeshow test 0.24, discriminant accuracy rate 87.9%.

n *=1783, **=870, ***=157.

odds ratio 1.65 (95% CI:1.4-2.40). For the 121 women aged 40 and over, the regression coefficient for hiesho was 0.69, p=0.23 and the odds ratio 2.0 (95% CI:0.64-6.23), showing no significant difference.

Table 6.   Incidence Rate for Prolonged Labor in the Presence or Absence of Hiesho by Age Group

Age	Regression Coefficient (B)	Standard Error (SE)	Wald Statistic (SE/B)^2	Degrees of Freedom	Significant Probability (p)	Odds Ratio (OR)	95% Confidence Interval (CI Value)
<35*	0.80	0.23	11.78	1	0.001	2.24	1.41-3.54
35-39**	0.93	0.37	6.36	1	0.012	2.56	1.23-5.26
40≤***	1.97	0.80	6.05	1	0.014	7.19	1.49-34.6

Goodness of fit of the model *: Chi-square test p<0.001, Hosmer-Lemeshow test 0.57, discriminant accuracy rate 94.4%.

**: Chi-square test p<0.001, Hosmer-Lemeshow test 0.22, discriminant accuracy rate 94.8%.

***: Chi-square test p=0.057, Hosmer-Lemeshow test 0.59, discriminant accuracy rate 93.0%.

n *=1783、**=870、***=157.

Table 7.   Incidence Rate for Atonic Bleeding in the Presence or Absence of Hiesho by Age Group

Age	Regression Coefficient (B)	Standard Error (SE)	Wald Statistic (SE/B)^2	Degrees of Freedom	Significant Probability (p)	Odds Ratio (OR)	95% Confidence Interval (CI value)
<35*	0.83	0.12	45.53	1	0.001	2.29	1.80-2.91
35-39**	0.50	0.19	7.12	1	0.008	1.65	1.14-2.40
40≤***	0.69	0.58	1.44	1	0.230	2.00	0.64-6.23

Goodness of fit of the model *: Chi-square test p<0.001, Hosmer-Lemeshow test 0.62, discriminant accuracy rate 74.7%.

**: Chi-square test p=0.004, Hosmer-Lemeshow test 0.29, discriminant accuracy rate 75.5%.

***: Chi-square test p=0.002, Hosmer-Lemeshow test 0.24, discriminant accuracy rate 86.0%.

n (excluding those who had undergone a Caesarean section) *=1595、**=711、***=121.

DISCUSSION

Relationship Between Advanced Maternal Age and Hiesho

Comparing mothers experiencing hiesho and those with no hiesho, the proportion of mothers with hiesho was around 40% for women under the age of 35, women aged 35 to 39 and women aged 40 and over alike. Although the condition of hiesho is not very well-known in the West, over 60% of women in Japan are said to experience hiesho [2]. Findings from this study indicated that hiesho in pregnant women manifests itself in all age groups.

Comparing abnormal delivery among the groups with and without hiesho, the most frequent abnormality among women with hiesho compared to those without hiesho was premature delivery, which occurred over three times more frequently in each age group. This was followed by prolonged labor, with an incidence rate more than twice as high, weak labor pains also more than twice as high, and atonic bleeding more than 1.7 times higher among women with hiesho compared to those without hiesho. As the above figures demonstrate, it can be assumed that hiesho creates a very high risk for abnormal delivery. Furthermore, since this risk was quite high even among women under the age of 35, it can be inferred that the very fact of having hiesho is a risk for all age groups.

That is because hiesho among pregnant women in all age groups impairs blood circulation in the body and can interfere with blood circulation to the uterus [3]. Additionally, those with hiesho may have weakened immune systems, weaker resistance and less natural healing ability [12], creating an increased likelihood of premature delivery, premature rupture of membranes, weak labor pains, prolonged labor and atonic bleeding. Weak labor pains and

prolonged labor can also have a secondary detrimental effect on uterine contractions, leading to atonic bleeding [13].

Japan has instituted guidelines for obstetric care. Women aged 35 to 39 are at particular risk for pregnancy-induced hypertension, diabetes and other complications at the time of delivery. Findings from this research indicate that hiesho is a risk factor and that steps should be taken to clearly identify hiesho during pregnancy and provide care to prevent and relieve hiesho.

Impact of Advanced Maternal Age on Abnormal Delivery in Women with Hiesho

Adding the advanced maternal age factor to having hiesho, the items most strongly influenced were weak labor pains, followed by prolonged labor and premature delivery. Hirano *et al*. [8] say that weak labor pains occur because the uterine muscle has deteriorated due to age, which causes primary weak labor pains due to less effective uterine muscle contractions, or secondary weak labor pains due to rigidity of the soft birth canal. Ooura also reports a rise in the occurrence of weak labor pains among mothers aged 37 and up [13]. In the case of weak labor pains, labor becomes prolonged since the pains fail to become strong enough for labor to progress [14]. Where premature delivery is concerned, Carolan's research [15] comparing mothers under 35 and aged 35 to 38 gives results of OR1.0 (95%CI: 0.9-1.1) and OR1.4 (95%CI: 1.1-1.7) for mothers aged 40 and over, showing a significant difference for mothers aged 40 and over. That is, not only hiesho but also advanced maternal age are factors increasing the risk of weak labor pains, prolonged labor and premature delivery. This means that mothers aged 40 and over, especially, need to be cautious.

Further, analyzing complications in the case of weak labor pains and premature delivery among women aged 40

and over, Hirano *et al*. [8] say that the increased incidence of uterine fibroids among mothers due to age also contributes to the increase in weak labor pains, and also cite fibroids as a complication causing premature delivery [14]. In this research, the incidence of fibroids was 6.7% among women under the age of 35, compared to 17.2% among women aged 40 and over.

Therefore, in addition to the risk of age itself, the risk of age-associated fibroids has an effect on weak labor pains and premature delivery, and it can be surmised that this risk is much higher among mothers aged 40 and over. Based on the above, impaired circulation in the case of hiesho, coupled with the risk of advanced maternal age and the risk of complications, leads to the synergy effect of a higher incidence rate of abnormal deliveries, namely premature delivery, weak labor pains, prolonged labor and atonic bleeding.

It is suggested that the importance of proper screening of the presence or absence of risk including hiesho, and appropriate prevention of hiesho and treatment of complications such as uterine fibroids, should be taken into account in nursing. Further, informing women about the importance of self-care and the need for early detection and treatment of abnormalities such as uterine fibroids not only during pregnancy, but also in pre-pregnancy health education, is an issue for the future. Additionally, while hiesho is one risk factor for abnormal delivery, the interplay of different factors could be involved as well, and thus further broad research into latent factors is needed.

For example, risk factors such as chorioamnionitis, periodontal disease or smoking could cause premature delivery. Therefore, further research is needed to clarify the relationship between presence or absence of each influencing factor and premature delivery in terms of how these factors can affect premature delivery.

CONCLUSIONS

Regardless of advanced maternal age, hiesho itself is a risk factor for premature delivery, premature rupture of membranes, weak labor pains, prolonged labor and atonic bleeding. Hiesho, coupled with advanced maternal age, is also responsible for a higher incidence of premature delivery, weak labor pains, prolonged labor and atonic bleeding.

CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest by any means with respect to this research manuscript.

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