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Original Article

Pregnancy outcomes according to increasing maternal age

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Abstract

Objectives: To investigate the risks of increasing maternal age on the perinatal and obstetric outcomes.

Materials and Methods: Information about 29,760 singleton pregnancies delivered between 2005 and 2008 was extracted from our database. Patients were categorized into four groups according to age: 20–29 years, 30–34 years, 35–39 years, and ≥40 years. Multivariable logistic regression analysis was used to evaluate the adjusted odd ratios (AORs) of adverse pregnancy outcomes according to maternal age after adjusting for parity, body mass index, medical history and use of *in vitro* fertilization.

Results: The majority of adverse perinatal outcomes were associated with a maternal age ≥35 years as follows: low birth weight (AOR 1.2 and 1.6 for women aged 35–39 years and ≥40 years, respectively); Apgar score < 7 at 1 minute (AOR: 1.7 and 1.8); and chromosomal anomaly (AOR: 2.7 and 12.3). However, women aged ≥30 years also had greater risks for adverse maternal outcomes such as: gestational diabetes (AOR: 2.0, 3.6 and 5.1 for women aged 30–34 years, 35–39 years and ≥40 years, respectively); placenta previa (AOR: 1.6, 2.1 and 3.6); and cesarean delivery (AOR: 1.5, 2.3, and 4.1), as well as adverse fetal outcomes such as: preterm delivery (AOR: 1.2, 1.4 and 1.8) and neonatal intensive care unit transfer (AOR: 1.1, 1.2, and 1.6).

Conclusion: Increasing maternal age is an independent and substantial risk factor for adverse perinatal and obstetric outcomes. These adverse outcomes become more common as increasing maternal age without a clear cutoff age.

Keywords: elderly pregnancy; maternal age; pregnancy outcome

Introduction

Increasing maternal age has been a worldwide trend. In the United States, live births among women aged ≥35 years increased from 5% to 13% between 1970 and 2000 [1], and the average age of first-time mothers increased from 21.4 years to 25.0 years between 1970 and 2006 [2]. In Sweden, the increase in the average age for first-time mothers was 2.9 years from 25.9 years to 28.8 years between 1970 and 2006 [2]. This trend of increasing maternal age has also appeared in Korea, so live births among women aged ≥35 years increased from 5% to 14% from 1996 to 2008, similar to that in the United States (3). This tendency may be caused by delayed marriage, increasing rates of divorce, development of assisted reproductive technology, effective birth control, women's higher education levels, and increases in women's social activity.

Advanced maternal age has been considered to be an obstetric risk factor for many years. Prior studies have reported that increasing maternal age is relevant to risks for various complications including preeclampsia, gestational diabetes mellitus (GDM), intrauterine fetal death, preterm birth, and cesarean delivery [3–8]. However, other studies have reported no association between maternal age and obstetric outcomes [9,10]. Thus, the effect of maternal age on adverse outcomes is still

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controversial. In 1958, the council of the International Federation of Gynecology and Obstetrics defined the age of elderly pregnancy as ≥35 years. However, the cutoff age that increases the risk of adverse outcomes clinically is still unclear. Furthermore, most previous studies regarding advanced maternal age were performed in the 1990s or early 2000s, so the current report is needed to represent recent trends regarding increasing maternal age.

This study was designed to investigate the effect of increasing maternal age on obstetric and perinatal outcomes, and to evaluate the proper definition of advanced maternal age.

Materials and methods

We extracted data from a computer database on deliveries or fetal extractions that happened after 14 weeks of gestation during a 4-year period between January 2005 and December 2008 at Cheil General Hospital. Cheil General Hospital is the largest institution in Korea specializing in women's health, which has around 1000 employees, including about 50 professors and medical specialists in obstetrics and gynecology. Approximately 8000 women give birth in this hospital each year. The obstetricians collect the information including maternal demographic characteristics, obstetric events and perinatal outcomes in the database prospectively. Gestational age was calculated from estimated date of delivery by ultrasound before 18 completed weeks of gestation. Women < 20 years of age at the time of delivery were excluded from this study to eliminate the influence of teenage pregnancy. As a result of the risks imposed by multiple pregnancies, we included only singleton pregnancies. Consequently, a total of 29,760 women aged ≥20 years were included in this study. The Ethics Committee of Cheil Hospital approved the use of the patients' clinical information for research purposes in this study (CGH-IRB-2009-57).

Subjects were classified into four groups according to maternal age at delivery: 20–29 years, 30–34 years, 35–39 years, and ≥40 years. The group of women aged 20–29 years was used as the reference group for all comparisons. In Korea, the proportion of women delivering at age 30–34 years is the highest in all age groups, therefore, we divided our population in that way. The demographic information consisted of gravidity, parity, history of spontaneous abortion, body mass index (BMI), history of *in vitro* fertilization (IVF) use in current pregnancy, and history of pre-existing medical conditions including chronic hypertension, pregestational diabetes, cardiac disease, thyroid disease, epilepsy, and asthma. The BMI calculated before 18 completed weeks of gestation at their first visit was used.

Perinatal and obstetric outcomes were analyzed. Perinatal outcomes included preterm delivery (<37 weeks of gestation), very preterm delivery (<32 weeks of gestation), extremely preterm delivery (<28 weeks of gestation), low birth weight (<2.5 kg), very low birth weight (<1.5 kg), extremely low birth weight (<1 kg), macrosomia (birth weight > 4 kg), small for gestational age (SGA; < 10^{th} percentile of birth weight for gestational age) [11], large for gestational age (LGA; > 90^{th} percentile of birth weight for gestational age) [11], chromosomal anomaly, congenital structural anomaly including major and minor anomaly without any confirmed chromosomal anomaly, miscarriage (fetal loss after enrollment but before $20^{0/7}$ weeks), and perinatal loss (intrauterine death after $19^{6/7}$ weeks gestation and neonatal death within 28 days of birth).

Obstetric outcomes consisted of antepartum complications and delivery mode. Antepartum complications were composed of hypertensive disorders complicating pregnancy (HTN) including gestational hypertension, preeclampsia, eclampsia, and superimposed hypertension); GDM; and preterm premature rupture of membranes (PPROM: membrane rupture before 37 weeks of gestation). Lastly, mode of delivery was classified as vaginal delivery or cesarean delivery, and indications for primary cesarean section involved arrest disorder, induction failure, placenta previa, and previous myomectomy.

Differences in characteristics between groups were assessed using the χ^2 test and one-way analysis of variance. Multivariable logistic regression analysis was used to evaluate the associations between maternal age and dependent outcome variables, namely to calculate the adjusted odd ratios (AORs) of pregnancy outcomes according to increasing maternal age by controlling for confounding factors. Potential confounding factors included gravidity, parity, history of spontaneous abortion, BMI, history of IVF use, and history of pre-existing medical conditions. AOR and 95% confidence intervals (CIs) were calculated. A p value < 0.05 was considered statistically significant. Statistical analysis was performed using SPSS version 12.0 (SPSS Inc., Chicago, IL, USA).

Results

A total of 29,760 women were distributed as follows: (1) 7950 (26.7%) aged 20–29 years; (2) 15,496 (52.1%) aged 30–34 years; (3) 5665 (19%) aged 35–39 years; and (4) 649 (2.2%) aged ≥40 years. The mean ages of the four groups were 28.0 ± 1.6 years, 32.3 ± 1.4 years, 36.7 ± 1.3 years and 41.5 ± 1.4 years, respectively.

Among women enrolled, 18,043 (60.6%) patients were nulliparous. Six thousand and fifty-one (20.3%) women had a history of at least one spontaneous abortion, and 444 (1.5%) experienced more than two spontaneous abortions. Nine hundred and forty-eight (3.2%) patients had conceived by means of IVF. Pre-existing medical conditions including chronic hypertension, pregestational diabetes mellitus, cardiac disease, thyroid disease, epilepsy, and asthma were detected in 1266 (4.3%) women. The demographic characteristics of the patients are summarized in Table 1. As expected, the older patients were more likely to be multiparous, to have a history of spontaneous abortion, to have a greater BMI, to receive IVF, and to have pre-existing medical conditions ($p < 0.001$ in all comparisons).

During the study period, the proportion of deliveries to women aged 20–29 years was continuously decreased, whereas the proportion of deliveries to women aged ≥35 years was continuously increased. Eventually, in 2008, the proportion of deliveries to women aged ≥35 years was higher than

Table 1
Demographic characteristics and medical histories by maternal age.

Characteristic	20–29 y (n = 7950)	30–34 y (n = 15,496)	35–39 y (n = 5665)	≥40 y (n = 649)	p
Gravidity	1.7 ± 01.0	2.1 ± 1.1	2.6 ± 1.5	3.1 ± 1.8	<0.001*
Parity	0.2 ± 0.4	0.5 ± 0.6	0.7 ± 0.7	0.9 ± 0.9	<0.001*
Primigravidity	81.1	56.7	41.4	40.5	<0.001
History of spontaneous abortion	12.4	20.5	28.7	40.5	<0.001
Body mass index (kg/m^2)	21.4 ± 3.2	21.7 ± 3.1	22.3 ± 3.2	23.0 ± 3.4	<0.001*
In vitro fertilization	1.2	3.1	5.9	6.6	<0.001
Pre-existing medical condition	2.8	4.3	5.9	6.6	<0.001
Chronic hypertension	0.3	0.5	0.8	1.7	<0.001
Pregestational diabetes mellitus	0.3	0.5	1.0	0.9	<0.001

Data are presented as mean ± standard deviation or %.
* One-way analysis of variance.

the proportion of deliveries to women aged 20–29 years (Fig. 1).

Table 2 shows a comparison of perinatal outcomes by maternal age. The mean gestational age at delivery for all patients was 38.7 ± 3.2 weeks, and the mean birth weight was 3204 ± 622 g. The mean gestational age at delivery decreased according to increasing maternal age ($p < 0.001$), and the mean birth weight decreased in women aged ≥35 years ($p < 0.001$). There were significant differences between groups for rates of chromosomal anomaly, congenital structural anomaly, perinatal loss, intrauterine fetal death, preterm delivery, very preterm delivery, extremely preterm delivery, low birth weight, very low birth weight, macrosomia, SGA, LGA, Apgar score at 1 minute, neonatal intensive care unit (NICU) transfer, and ventilator care ($p < 0.05$ in all). However, there were no significant differences between groups for rates of miscarriage, extremely low birth weight, or Apgar score at 5 minutes (Table 2).

After the confounding factors were adjusted, maternal ages of 30–34 years were not associated with most of the perinatal complications (Table 3). However, maternal ages of ≥35 years were significantly associated with increased risks for chromosomal anomaly, preterm delivery, low birth weight, NICU transfer, and ventilator care. Contrary to expectations, the risk of SGA was found to be decreased in women aged 35–39 years and ≥40 years [AOR (95% CI): 0.9 (0.7–1.0) and 0.6 (0.4–0.9)].

The obstetric outcomes by maternal age are described in Tables 4 and 5. In antepartum complications, the rates of HTN, GDM, PPROM, and placenta accreta differed significantly between groups ($p < 0.001$ in all), whereas the rates of oligohydramnios, polyhydramnios, and placenta abruption did not (Table 4). Women aged 30–34 years had increased risks for GDM and placenta previa. Moreover, women aged 35–39 years and ≥40 years had significantly higher risks of HTN, GDM, PPROM, placenta previa and placenta accreta (Table 5).

The rates for primary cesarean section and some of its indications including induction failure and previous myomectomy increased significantly according to increasing maternal age ($p < 0.001$ in all comparisons). However, the rates of nonvertex presentation and arrest disorder did not differ significantly (Table 4). After the confounding factors were adjusted, women aged ≥40 years also had an increased risk of arrest disorder.

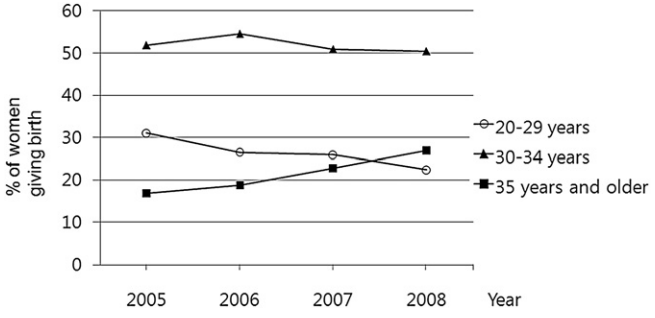

Fig. 1. Proportions of women giving birth at 20–29 years, 30–34 years and ≥35 years for the entire sample aged ≥20 years during the past 4 years (2005–2008).

Discussion

Our investigation indicates that increasing maternal age is an independent risk factor for various perinatal and obstetric outcomes. The rates of preterm delivery, NICU transfer, GDM, placenta previa, induction failure, and primary cesarean section were progressively increased with increasing maternal age groups. The risk of increasing maternal age has been reported in many studies. In particular, Jane et al have described that the women aged ≥40 years had a 9.9 times greater risk of chromosomal anomaly than that of women aged < 35 years [12–15]. Our results were similar to those of previous studies, and the risk of chromosomal anomaly was dramatically elevated in women aged ≥40 years (AOR: 12.3) as the most adverse pregnancy outcome.

Regarding preterm delivery, the risks for preterm, very preterm, and extremely preterm delivery were increasingly higher in women aged 35–39 years. Another author has presented similar results in a study of 26,891 singleton pregnancies [16]. However, in that study, preterm deliveries were not subdivided into preterm, very preterm, and extremely preterm delivery. Moreover, in that study, some important confounding factors such as gravidity and BMI were not considered.

In the First and Second Trimester Evaluation of Risk (FASTER) trial, a prospective multicenter study in 2005 including 36,056 patients, a maternal age of ≥40 years at delivery was an independent risk factor for placental abruption and perinatal mortality [12]. However, in our study, we did not

Table 2
Perinatal outcomes by maternal age.

Outcome	20–29 y (n = 7950)	30–34 y (n = 15,496)	35–39 y (n = 5665)	≥40 y (n = 649)	p
Miscarriage	0.5	0.5	0.7	1.2	0.052
Chromosomal abnormality	0.4	0.4	1.0	3.9	<0.001
Congenital anomaly	5.2	4.8	5.7	6.0	0.036
Perinatal loss	0.5	0.7	1.1	0.6	0.003
Intrauterine fetal death	0.5	0.6	0.8	0.9	0.040
Mean gestational age (wk)	38.9 ± 3.0	38.8 ± 3.1	38.4 ± 3.5	37.4 ± 5.0	<0.001*
Preterm (<37 wk)	4.9	5.4	6.9	8.6	<0.001
Very preterm (<32 wk)	0.8	1.0	1.6	0.9	<0.001
Extremely preterm (<28 wk)	0.5	0.6	0.9	0.6	0.008
Mean birth weight (g)	3206 ± 593	3216 ± 606	3187 ± 674	3046 ± 847	<0.001*
Low (<2.5 kg)	4.4	4.1	5.1	6.3	<0.003
Very low (<1.5 kg)	1.0	0.9	1.3	1.7	<0.016
Extremely low (<1 kg)	0.7	0.6	0.9	0.9	0.119
Macrosomia (>4 kg)	4.1	4.7	5.1	4.0	0.027
SGA (birth weight < 10th percentile)	8.4	7.4	7.2	5.4	<0.001
LGA (birth weight > 90th percentile)	9.6	10.5	12.2	10.5	0.003
Apgar score 1 min < 7	2.9	3.0	4.1	4.9	<0.001
5 min < 7	0.6	0.7	0.8	1.1	0.231
Neonatal intensive care unit	7.3	8.0	8.7	11.4	<0.001
Ventilator care	3.6	4.1	4.8	6.0	<0.001

Data are presented as mean ± standard deviation or %. *, one-way ANOVA.
Reference for the determination of SGA and LGA: 12.
LGA = large for gestational age; SGA = small for gestational age.

find a definite association between maternal age and placental abruption or perinatal loss. In the FASTER trial, the risk of adverse pregnancy outcomes in women aged 30–34 years was not compared with those in woman aged 20–29 years. Moreover, women < 20 years, who might elevate any risk of adverse outcomes, were included in the reference group. These differences between the FASTER trial and our study may explain the conflicting results.

Table 3
AORs of perinatal outcomes by maternal age.

Outcome	30–34 y vs. referent		35–39 y vs. referent		≥40 y vs. referent	
	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p
Miscarriage	1.0 (0.7–1.5)	0.963	1.0 (0.6–1.7)	0.943	1.8 (0.8–4.3)	0.169
Chromosomal abnormality	1.3 (0.8–2.0)	0.306	2.7 (1.6–4.4)	<0.001	12.3 (6.5–23.2)	<0.001
Congenital anomaly	0.9 (0.8–1.0)	0.196	1.0 (0.9–1.2)	0.714	1.0 (0.7–1.5)	0.956
Perinatal loss	1.4 (0.9–2.0)	0.118	2.3 (1.5–3.6)	<0.001	1.4 (0.5–4.3)	0.555
Intrauterine fetal death	1.3 (0.8–1.9)	0.267	1.7(1.0–2.8)	0.036	2.3 (0.9–6.0)	0.087
Mean gestational age (wk)						
Preterm (<37 wk)	1.2 (1.0–1.3)	0.029	1.4 (1.2–1.7)	<0.001	1.8 (1.3–2.4)	0.001
Very preterm (<32 wk)	1.0 (0.9–1.2)	0.282	1.9 (1.3–2.7)	0.001	0.9 (0.3–2.2)	0.764
Extremely preterm (<28 weeks)	1.0 (0.9–1.3)	0.244	2.0 (1.3–3.3)	0.003	1.1 (0.3–3.4)	0.899
Mean birth weight (g)						
Low (<2.5 kg)	1.0 (0.9–1.2)	0.959	1.2 (1.0–1.5)	0.024	1.6 (1.1–2.3)	0.014
Very low (<1. kg)	0.9 (0.6–1.1)	0.303	1.1 (0.8–1.6)	0.568	1.4 (0.7–2.8)	0.343
Extremely low (<1 kg)	0.9 (0.6–1.2)	0.371	1.1 (0.7–1.8)	0.543	1.3 (0.5–3.3)	0.541
Macrosomia (>4 kg)	1.2 (1.0–1.3)	0.127	1.2 (1.0–1.4)	0.081	0.9 (0.6–1.4)	0.658
SGA (birth weight < 10th percentile)	0.9 (0.8–1.0)	0.865	0.9 (0.7–1.0)	0.031	0.6 (0.4–0.9)	0.016
LGA (birth weight > 90th percentile)	1.1 (1.0–1.2)	0.010	1.4 (1.2–1.5)	<0.001	1.2 (0.8–1.5)	0.412
Apgar score 1 min < 7	1.1 (0.9–1.4)	0.104	1.7 (1.4–2.1)	<0.001	1.8 (1.2–2.7)	0.007
5 min < 7	1.2 (0.9–1.8)	0.238	1.5 (0.9–2.3)	0.097	1.6 (0.7–4.0)	0.270
Neonatal intensive care unit	1.1 (1.0–1.2)	0.043	1.2 (1.1–1.4)	0.003	1.6 (1.2–2.1)	0.001
Ventilator care	1.2 (1.0–1.3)	0.052	1.4 (1.1–1.7)	0.001	1.7 (1.2–2.5)	0.005

AORs were obtained by controlling for the effects of gravidity, parity, body mass index, history of spontaneous abortion, history of *in vitro* fertilization, and pre-existing medical conditions.
Referent used was the group including all patients aged 20–29 years at delivery.
Reference for the determination of SGA and LGA: 12.
AOR = adjusted odds ratio; CI = confidence interval; LGA = large for gestational age; SGA = small for gestational age.

Table 4
Obstetric outcomes by maternal age.

Outcome		20–29 y (n = 7950)	30–34 y (n = 15,496)	35–39 y (n = 5665)	≥40 y (n = 649)	p
Antepartum Complications	HTN	2.1	1.9	2.3	4.8	<0.001
	GDM	1.2	2.5	4.4	6.8	<0.001
	PPROM	1.4	1.6	2.2	3.4	<0.001
	Oligohydramnios	4.7	4.7	4.0	4.6	0.205
	Polyhydramnios	0.2	0.2	0.2	0.2	0.753
	Placenta previa	1.0	1.7	2.7	4.8	<0.001
	Placenta accreta	0.3	0.4	0.7	1.2	<0.001
	Placenta abruption	0.2	0.3	0.3	0.5	0.642
Mode of delivery and indication for cesarean section	Vaginal delivery	70.6	61.6	49.7	29.9	<0.001
	Primary cesarean section	21.9	22.0	24.8	37.9	<0.001
	Nonvertex presentation	4.4	4.2	4.0	5.4	0.300
	Arrest disorder	11.3	10.6	11.0	12.9	0.130
	Induction failure	1.2	1.3	1.5	3.1	<0.001
	Placenta previa	0.9	1.4	2.2	3.4	<0.001
	Previous myomectomy	0.5	1.1	1.7	3.2	<0.001
	Other indications	3.6	3.4	4.4	9.9	

Data are presented as %.
GDM = gestational diabetes mellitus; HTN = hypertensive disorders complicating pregnancy; PPROM = preterm premature rupture of membranes.

In addition, we did not detect any association between miscarriage and maternal age; a result that differs from those of previous studies [12,17]. One possible explanation would be the early detection of chromosomal or congenital anomaly, an important cause of miscarriage because of closer fetal surveillance in older women, and it is followed by iatrogenic termination of pregnancy.

In women aged ≥40 years, more than one of every three women delivered by cesarean section. For indications of cesarean section, our data showed that the risk for arrest disorder was higher in women aged ≥40 years. However, if a patient wanted cesarean delivery during labor, the indication for cesarean delivery was occasionally recorded as an arrest disorder due to requirements of the Korean National Health Insurance Corporation. Furthermore, physicians tend to worry more about older mothers, and this concern is especially pronounced for women aged ≥40 years [18,19]. Therefore, it is unclear whether women aged ≥40 years have actual higher intrinsic risk factors for arrest disorder.

Reports regarding HTN risk according to maternal age are diverse. Jacobsson has reported an increased risk of severe preeclampsia and a decreased risk of mild preeclampsia in women with advanced maternal age [20]. However, Jane et al have reported no significant increase in risk for hypertensive complications of pregnancy such as gestational hypertension or preeclampsia with advanced maternal age [12]. In our study, the risk for HTN increased with maternal age, but the result was statistically significant only in women aged ≥40 years.

The cutoff age that increases the risk of adverse outcomes clinically is still unclear, and appears to range between 30 years

Table 5
AORs of obstetric outcomes by maternal age.

Outcome		30–34 y vs referent		35–39 y vs referent		≥ 40 y vs referent	
		AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p
Antepartum complications	HTN	1.0 (0.8–1.2)	0.955	1.3 (1.0–1.7)	0.052	2.8 (1.8–4.3)	<0.001
	GDM	2.0 (1.6–2.6)	<0.001	3.6 (2.8–4.8)	<0.001	5.1 (3.3–7.8)	<0.001
	PPROM	1.2 (1.0–1.5)	0.101	1.7 (1.2–2.2)	0.001	2.6 (1.6–4.4)	0.001
	Oligohydramnios	1.1 (1.0–1.3)	0.062	1.0 (0.9–1.3)	0.666	1.2 (0.8–1.8)	0.370
	Polyhydramnios	0.7 (0.4–1.3)	0.268	0.9 (0.4–2.4)	0.891	0.7 (0.1–6.5)	0.777
	Placenta previa	1.6 (1.2–2.0)	0.001	2.1 (1.5–2.9)	<0.001	3.6 (2.2–5.7)	<0.001
	Placenta accreta	1.5 (0.9–2.4)	0.159	2.6 (1.4–4.8)	0.004	3.1 (1.2–8.0)	0.022
	Placenta abruption	1.3 (0.8–2.3)	0.322	0.9 (0.4–1.9)	0.765	1.2 (0.3–4.5)	0.815
Mode of delivery and indication for cesarean section	Vaginal delivery	0.7 (0.6–0.7)	<0.001	0.4 (0.4–0.5)	<0.001	0.2 (0.2–0.2)	<0.001
	Primary cesarean section	1.4 (1.3–1.5)	<0.001	2.1 (1.9–2.3)	<0.001	3.9 (3.2–4.8)	<0.001
	Nonvertex presentation	1.1 (1.0–1.3)	0.137	1.1 (0.9–1.3)	0.334	1.4 (1.0–2.1)	0.065
	Arrest disorder	1.3 (1.2–1.4)	0.071	0.9 (0.8–1.0)	0.088	1.9 (1.5–2.5)	<0.001
	Induction failure	1.4 (1.1–1.8)	0.005	1.9 (1.4–2.6)	<0.001	3.7 (2.1–6.3)	<0.001
	Placenta previa	1.5 (1.1–2.0)	0.001	1.9 (1.4–2.6)	0.001	2.8 (1.6–4.8)	<0.001
	Previous myomectomy	1.3 (0.8–2.3)	0.322	5.6 (3.8–8.3)	<0.001	10.0 (5.4–18.3)	<0.001

AORs were obtained by controlling for the effects of gravidity, parity, body mass index, history of spontaneous abortion, history of *in vitro* fertilization, and pre-existing medical conditions.
Referent used was the group including all patients aged 20–29 years at delivery.
AOR = adjusted odds ratio; CI = confidence interval; GDM = gestational diabetes mellitus; HTN = hypertensive disorders complicating pregnancy; PPROM = preterm premature rupture of membranes.

and 40 years, depending on specific studies [3,5]. Another study has reported that the effects of increasing maternal age are a continuum rather than a threshold effect [12]. In our investigation, we found that even women aged 30–34 years at delivery had higher risks for adverse outcomes such as preterm delivery, LGA, NICU transfer, GDM, placenta previa, cesarean delivery, and induction failure than those of women aged 20–29 years. Furthermore, most of these risks increased with maternal age, so it is inappropriate to declare 35 years or 40 years to be the clear cutoff age of elderly pregnancy [21,22].

There were some limitations in our study. First, the sample size of women aged ≥40 years was small relatively. Second, we did not consider the potential confounding factors such as the socioeconomic status of patients because of our initial setup in the database.

Worldwide, a decline in birth rate and delayed childbearing are becoming general phenomena. As maternal age increases, the risk of adverse perinatal and obstetric outcome is elevated consistently. Therefore, the physician should explain thoroughly about the risk of increasing maternal age to women who are planning a pregnancy. As delayed childbearing continues to increase in our society, this study can provide more useful and precise information to health care providers to prepare them for pregnancy counseling.

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