Advanced Maternal Age Among Nulliparous at Term and Risk of Unscheduled Cesarean Delivery

Axelle Braggion, MSc; Guillaume Favre, MD; Karine Lepigeon, MSc; Joanna Sichitiu, MD; David Baud, MD, PhD; David Desseauve, MD, PhD

BACKGROUND: With the rise in the number of women giving birth at an advanced age, the association between advanced maternal age and adverse obstetrical outcomes is a growing concern in developed countries. Despite the well-established link between advanced maternal age and pregnancy-related complications, there has been limited research examining the specific risks related to unscheduled cesarean delivery in nulliparas at term.

OBJECTIVE: This study aimed to evaluate the risks associated with unscheduled cesarean delivery in nulliparas at ≥37 weeks of gestation, comparing the outcomes of younger patients with those aged ≥40 years.

STUDY DESIGN: This retrospective cohort study was conducted in a tertiary maternity hospital in Switzerland (high-income country). The study included nulliparas who delivered a live-born infant at ≥37 weeks between January 2015 and December 2019. We excluded pregnant women who had a planned cesarean delivery, were aged <18 years, multiparous, delivered before 37 weeks of gestation, or had pregnancies that ended in stillbirth. Participants were divided into 2 age groups: (1) ≥40 years and (2) <40 years. The primary outcome was the incidence of unscheduled cesarean delivery. Its association with advanced maternal age was evaluated after adjusting for confounding factors by multivariate logistic regression, expressed as an adjusted odds ratio. Secondary outcomes included pregnancy outcomes and neonatal outcomes.

RESULTS: A total of 5211 patients were included: 173 in the ≥40-years (advanced maternal age) group and 5038 in the <40-years (non−advanced maternal age) group; 26.01% (95% confidence interval, 19.65−33.22; n=45) of women in the advanced maternal age group had an unscheduled cesarean delivery, whereas 15.26% (95% confidence interval, 14.28−16.29; n=769) of women in the non−advanced maternal age group underwent the procedure. Advanced maternal age was associated with unscheduled cesarean delivery, with an adjusted odds ratio of 1.51 (95% confidence interval, 1.06−2.17; *P*=.024). Among vaginal deliveries, assisted procedures were performed on 29.7% (95% confidence interval, 21.9−38.4; n=38) of advanced maternal age patients vs 20.1% (95% confidence interval, 18.9−21.3; n=856) of non−advanced maternal age patients. Postpartum blood loss >1000 mL occurred in 5.8% (95% confidence interval, 2.8−10.4; n=10) of advanced maternal age patients and 3.1% (95% confidence interval, 2.6−3.6; n=156) of non−advanced maternal age patients.

CONCLUSION: Advanced maternal age is associated with increased risk of unscheduled cesarean delivery among nulliparas. This provides healthcare professionals with confirmation that advanced age may represent an individual risk factor, suggesting that nulliparous patients aged over 40 years may benefit from improved information regarding the factors contributing to this pregnancy outcome.

Key words: Advanced maternal age, cesarean delivery, delivery outcome, pregnancy outcome

Introduction

Maternal age has been increasing globally over the past decades, as noted in most countries by the Organisation for Economic Co-operation and Development, with 2 to 5 years older mothers at childbirth in 2019 compared with 1970.[1] In several high-income countries, the birth rate has risen for women in their late 30s.[1−5]

Pregnancies among older patients have been associated with adverse maternal and neonatal outcomes. Many studies have demonstrated increased pregnancy complications among women of advanced maternal age (AMA), including preterm delivery, miscarriage, gestational diabetes mellitus, preeclampsia, and small for gestational age.[2,3,6−9] Cesarean deliveries also seem to be more frequent among older women.[2,3,8−11]

In 2010, a systematic review demonstrated that the risk of cesarean delivery was significantly higher for aged patients than for younger women.[10] Nevertheless, most studies analyzed the risk of cesarean delivery without distinguishing planned from unplanned cesarean deliveries.[2,3,8−10] Whereas a planned procedure might be indicated for various reasons, an emergency cesarean delivery is often performed when fetal distress occurs. Given that elective and unplanned cesarean deliveries have very different leading causes and indications, unscheduled cesarean deliveries need to be addressed separately. In addition, studies have reported results from women aged ≥35 years, and very few have specifically focused their analysis on patients aged over 40 years. Similarly, studies should focus on deliveries beyond 37 weeks when assessing the association between AMA and unscheduled cesarean deliveries. Preterm deliveries are more frequent among older women,[9] leading to a higher rate of cesarean deliveries in the context of induced prematurity.

This study aimed to assess the risk of unscheduled cesarean delivery from 37 weeks of gestation in nulliparous

Cite this article as: Braggion A, Favre G, Lepigeon K, et al. Advanced Maternal Age Among Nulliparous at Term and Risk of Unscheduled Cesarean Delivery. Am J Obstet Gynecol MFM 2023;5:100972.

2589-9333/$36.00

http://dx.doi.org/10.1016/j.ajogmf.2023.100972

AJOG MFM at a Glance

Why was this study conducted?

The age of women giving birth has increased over the years and has been reported to be associated with adverse maternal and neonatal outcomes. Most studies have assessed women aged ≥35 years and analyzed the overall risk of cesarean delivery, mixing planned and unscheduled cesarean deliveries. We aimed to assess the risk of unscheduled cesarean delivery among nulliparous pregnant women aged ≥40 years compared with younger women.

Key findings

Nulliparous pregnant women aged ≥40 years had a higher risk of unscheduled cesarean delivery, with an adjusted odds ratio of 1.53 (95% confidence interval, 1.06−2.19) compared with younger women.

What does this add to what is known?

These results add to the existing evidence that nulliparous advanced-age women are at risk of unscheduled cesarean delivery. This study emphasizes that the specific population of nulliparas aged ≥40 years should benefit from receiving clear and dedicated information.

pregnant women with AMA ≥40 years compared with younger ones

Methods

Study design and setting

This retrospective cohort study was performed in a tertiary university hospital in Lausanne, Switzerland. Data were extracted from the medical records of patients who gave birth between January 2015 and December 2019. Deidentified data were extracted from local electronic records. The study was approved by the Swiss Ethical Board (CER-VD-2019-01349).

Population

Nulliparas who delivered a live-born infant at ≥37 weeks of gestation were included. Pregnant women who had a planned cesarean delivery were excluded. Patients with unknown maternal age, chorionicity, gestational age at delivery, type of delivery, and pregnancy outcome were excluded. Women aged <18 years, multiparous patients, deliveries before 37 weeks of gestation, and pregnancies ending in a stillbirth were also excluded. Women who objected to using their data for research purposes were omitted.

Advanced maternal age definition

AMA was defined as ≥40 years at the time of delivery. The control group was composed of pregnant women aged <40 years.

Primary outcome

The primary outcome was unscheduled cesarean delivery. This type of cesarean delivery was defined as a nonplanned procedure, performed either outside or during induction/labor, for any underlying reason. The following indications for unscheduled cesarean delivery were studied: labor arrest during dilation (including failed induction of labor), labor arrest during descent (including failed instrumental delivery), nonreassuring fetal heart tracing, preeclampsia/eclampsia/HELLP (hemolysis, elevated liver enzymes, low platelet count) syndrome, malpresentation, maternal indication, obstetrical indication, and maternal request.[12]

The primary outcome was analyzed in the subpopulation who underwent a trial of labor. Trial of labor was defined as a scenario in which a vaginal birth was contemplated. Patients who experienced a spontaneous labor or induction of labor were included. In addition, we included women who underwent expectant management, such as those with premature rupture of membranes observed for 24 hours before labor induction, following our local protocol. Excluded from this subpopulation were patients who underwent unscheduled cesarean delivery outside of labor or induction of labor (eg, severe preeclampsia, premature rupture of membranes with fetal malpresentation such as transverse or breech presentation, fetopelvic disproportion). Induction of labor was defined as the use of any method (mechanical or chemical) to initiate contractions. Prelabor or spontaneous labor was defined as women experiencing contractions without the use of induction methods.

Secondary outcomes

Secondary outcomes were classified into pregnancy outcomes and neonatal outcomes.

Pregnancy outcomes. The following pregnancy outcomes were studied: vaginal mode of delivery and postpartum blood loss. The vaginal mode of delivery was divided into spontaneous vaginal delivery and assisted vaginal delivery, which included forceps or vacuum extraction delivery. Postpartum blood loss was divided into 3 groups: (1) 500 mL, (2) >500 and ≤1000 mL, (3) >1000 and ≤1500 mL, and (4) >1500 mL.[13] The type of anesthesia for cesarean delivery was divided into epidural, spinal, and general anesthesia.

Neonatal outcomes. Regarding neonatal outcomes, we investigated: macrosomia (defined as birthweight >4000 g), low birthweight (divided into <10th percentile and <3rd percentile for gestational age according to the World Health Organization charts[14]), low 5-minute Apgar score (defined as <7), and neonatal intensive care unit (NICU) admission.

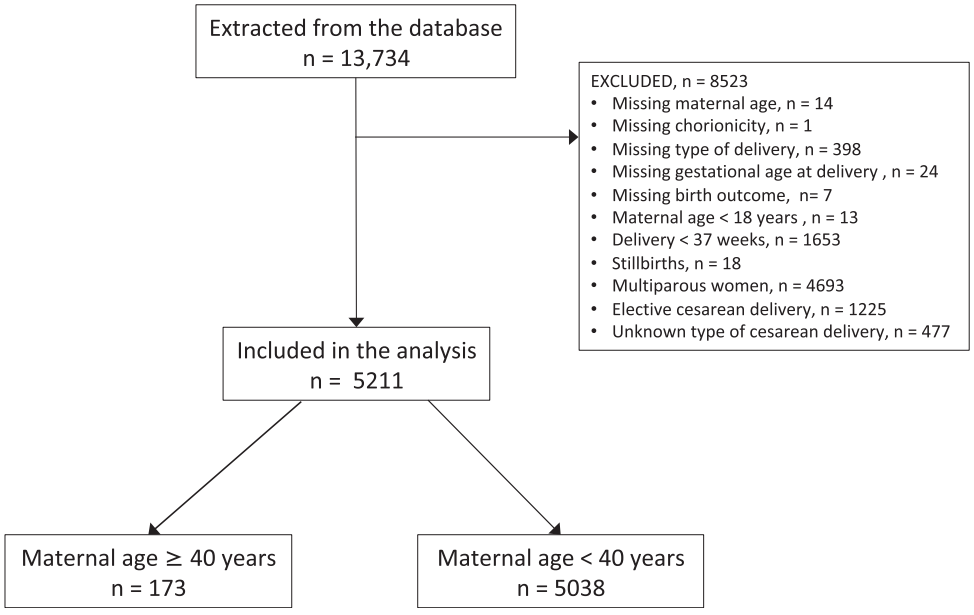
Covariates

Baseline characteristics included maternal age at birth, pregestational diabetes mellitus, pregestational hypertension, multiple pregnancy, induction of labor (any method), and oxytocin administration for labor stimulation.

Statistical analysis

Baseline characteristics and outcomes were presented with descriptive statistics using proportions and 95% confidence intervals (CIs). Univariate logistic

FIGURE
Flowchart of the study population



Unknown type of cesarean delivery (no information on whether it was planned, or if it was a cesarean delivery during labor).

Braggion. Advanced maternal age among nulliparas at term and risk of unscheduled cesarean delivery. Am J Obstet Gynecol MFM 2023.

regression was performed to analyze the primary outcome, reporting crude odds ratios (ORs). We performed a multivariate logistic regression, reporting adjusted OR (aOR) and 95% CI. In the model, we included all unbalanced baseline characteristics and labor management factors across all groups, defined as having a standardized difference >10% between groups. A *P* value of <.05 was considered significant. Analyses were performed using Stata, version 17 (StataCorp, College Station, TX).

Results

From January 2015 to December 2019, information pertaining to 13,734 women was extracted from the hospital database. The following exclusion criteria were applied: unknown maternal age (n=14), unknown chorionicity (n=1), unknown gestational age at delivery (n=24), unknown type of delivery (n=398), unknown pregnancy outcome (n=7), patients aged <18 years (n=13), patients who delivered before 37 weeks of gestation (n=1653), stillbirths (n=18), and multiparas (n=4693). A total of 1225 patients with planned cesarean deliveries and 477 with an unknown type of cesarean delivery were also excluded (Figure).

A total of 5211 women were included. The median maternal age was 30 years, with an interquartile range (IQR) of 27 to 34. There were 173 (3.3%) women aged ≥40 years (AMA) and 5038 (96.7%) aged <40 years. The baseline characteristics of the patients included are presented in Table 1. The median age in the ≥40-years group was 41 years (IQR, 40−43) and 30 years (IQR, 27−33) in the <40-years group. Women with AMA had a twin pregnancy in 2.9% (n=5) of cases and those with non-AMA in 0.6% (n=31) of cases. Breech presentation was observed in 1.7% (n=3) and 1.6% (n=80) of patients with AMA and non-AMA, respectively. Induction of labor was performed in 60.1% (n=104) of the AMA group and 35.6% (n=1795) of the non-AMA group. Stimulation with oxytocin during labor was used in 12.1% (n=21) and 15.5% (n=781) of the AMA and non-AMA groups, respectively.

Primary outcome

Patients underwent an unscheduled cesarean delivery in 26.0% (95% CI, 19.7−33.2; n=45) of cases in the AMA group and 15.3% (95% CI, 14.3−16.3; n=769) of cases in the non-AMA group. The reasons for unscheduled cesarean delivery are detailed in Table 2. Unscheduled cesarean delivery following induction of labor occurred in 30.8% (95% CI, 22.1−40.6; n=32) and 23.0% (95% CI, 21.1−25.1; n=414) of cases in the AMA and non-AMA groups, respectively (Table 2). Unscheduled cesarean delivery following prelabor or spontaneous labor was observed in 15.2% (95% CI, 8.7−23.7; n=10) of women with AMA and 7.4% (95% CI, 6.5−8.4; n=232) of women with non-AMA (Table 2). The cesarean delivery indications for twin and breech presentation pregnancies are provided in the Supplementary materials, Table S1.

AMA women had a significantly higher risk of unscheduled cesarean delivery compared with non-AMA women, with an OR of 1.95 (95% CI, 1.38−2.76; *P*<.001) and an Aor of 1.53 (95% CI, 1.06

TABLE 1
Baseline characteristics and labor management among nulliparous pregnant women from 37 weeks of pregnancy by age group (≥40 vs <40 years)

Characteristics	≥40 y		<40 y		SD (%)
	n	%	n	%	
Total patients	173		5038		—
Maternal age in y (IQR)	41 (40–43)		30 (27–33)		—
Maternal conditions					
Pregestational hypertension	3	1.7	33	0.7	9.9
Pregestational diabetes mellitus	0	0.0	43	0.9	−13.1
Pregnancy					
Singleton	168	97.1	5007	99.4	−17.4
Twin pregnancy	5	2.9	31	0.6	17.4
Presentation					
Breech	3	1.7	80	1.6	1.1
Prelabor/labor management					
Induction (any method)	104	60.1	1797	35.7	50.5
Labor stimulation with oxytocin	21	12.1	781	15.5	−9.7

IQR, interquartile range; *SD*, standardized difference.

Braggion. Advanced maternal age among nulliparas at term and risk of unscheduled cesarean delivery. Am J Obstet Gynecol MFM 2023.

−2.19; *P*<.021) after adjustment for unbalanced potential confounders (multiple pregnancy and induction of labor). In the subgroup undergoing trial of labor, AMA women had a significantly higher risk of unscheduled cesarean delivery compared with non-AMA women, with an OR of 2.17 (95% CI, 1.52−3.10; *P*<.001) and an aOR of 1.61 (95% CI, 1.11−2.34) (Table 2).

Secondary outcomes

Secondary outcomes according to maternal age are described in Table 3.

Pregnancy outcomes. Vaginal delivery was observed in 73.99% (n=128) of cases in the AMA group and 84.74% (n=4269) of cases in the non-AMA group, whereas assisted deliveries were performed in 29.7% (n=38) of AMA patients and 20.1% (n=856) of non-AMA patients. Overall, the proportion of postpartum blood loss >1000 mL was higher in the AMA (5.8%; n=10) than in the non-AMA (3.1%; n=156) group. The AMA group also had higher proportions of vaginal birth (6.3% [n=8] vs 3.0% [n=126]) and unscheduled cesarean deliveries (4.4% [n=2] vs 3.9% [n=30]).

Neonatal outcomes. Fetal macrosomia was observed in 3.47% (n=6) and 5.36% (n=270) of AMA and non-AMA women, respectively. Birthweight <10th percentile was observed in 9.25% (n=16) of AMA and 7.19% (n=362) of non-AMA patients. The respective rates for newborns with birthweight below the third percentile were 5.20% (n=9) and 2.18% (n=110). Apgar score at 5 minutes was <7 in 2.89% (n=5) of AMA and 1.89% (n=95) of non-AMA infants. Arterial cord blood pH was <7.15 in 8.97% (n=78) and 8.69% (n=1099) of the AMA and non-AMA groups, respectively. AMA and non-AMA newborns were admitted to the NICU in 5.20% (n=9) and 2.30% (n=116) of cases, respectively.

Discussion

Principal findings

Our study illustrates that AMA of ≥40 years was associated with a higher risk of unscheduled cesarean delivery. Women aged over 40 years had increased risk for this procedure compared with those aged <40 years, with an aOR of 1.53 (95% CI, 1.06−2.19) overall and an aOR of 1.61 (95% CI, 1.11−2.34) when considering women with a trial of labor. This finding is noteworthy because the number of women delaying pregnancy and delivering their first child at an AMA is rising worldwide. The primary reason for unscheduled cesarean delivery overall was nonreassuring fetal heart tracing, as reported in 55.6% (95% CI, 40.0−70.4) and 46.7% (95% CI, 43.1−50.3) of the AMA and non-AMA groups, respectively.

Results in the context of what is known

When examining the risk of unscheduled cesarean delivery in nulliparous patients with regard to AMA, our findings align with existing literature.[11,15–17] Kim et al[16] reported a similar finding, with an even stronger association between emergency cesarean deliveries and maternal age of ≥40 years, with an aOR of 4.66 (95% CI, 2.71−8.01). Nevertheless, the difference in the aORs could be attributed to the comparison group used, which consisted only of women aged <30 years. Furthermore, they excluded fetuses with low birthweight (<2500 g) and macrosomia (>4000 g). Similarly, a population-based study conducted in Norway found an adjusted relative risk ratio of 6.60 (95% CI, 5.53−7.87).[11] However, their comparison group included women aged 20 to 24 years, younger than the group in our study. In addition, their analysis excluded pregnancies with a breech presentation, which was not an exclusion criterion in our study. Our maternity unit follows guidelines from the American College of Obstetricians and Gynecologists and the Royal College of Obstetricians and Gynaecologists, which suggest that a planned vaginal delivery of a term breech

TABLE 2
Proportions and risk of unscheduled cesarean delivery among nulliparous pregnant women from 37 weeks of pregnancy by maternal age group and trial of labor status

	≥40 y			<40 y						
Outcomes	n	%[a]	95% CI	n	%[a]	95% CI				
Total of patients	n=173			n=5038			cOR (95% CI)	*P* value	aOR (95% CI)	*P* value
Unscheduled cesarean deliveries	45	26.01%	19.7–33.2	769	15.26%	14.3–16.3	1.95 (1.38–2.76)	<.001	1.53 (1.07–2.19)[a]	.021
Indications for unscheduled cesarean delivery	n=45			n=769						
Labor arrest (dilation)	10	22.2%	11.2–37.1	122	15.9%	13.4–18.6				
Labor arrest (descent)	5	11.1%	3.7–24.1	160	20.8%	18.0–23.9				
Nonreassuring fetal tracing	25	55.6%	40.0–70.4	359	46.7%	43.1–50.3				
Preeclampsia/HELLP/eclampsia	1	2.2%	0.1–11.8	14	1.8%	1.0–3.0				
Malpresentation	2	4.4%	0.5–15.2	69	9.0%	7.1–11.2				
Maternal indication	0	0.0%	—	8	1.0%	0.5–2.0				
Obstetrical indication	1	2.2%	0.1–11.8	17	2.2%	1.3–3.5				
Maternal request	1	2.2%	0.1–11.8	20	2.6%	1.6–4.0				
Patients with TOL	n=170			n=4915			cOR (95% CI)	*P* value	aOR (95% CI)	*P* value
Unscheduled cesarean deliveries	42	24.7%	18.4–31.9	646	13.1%	12.2–14.1	2.17 (1.52–3.10)	<.001	1.61 (1.11–2.34)[a]	.012
Indications for unscheduled cesarean delivery after TOL										
Labor arrest (dilation)	10	23.8%	12.1–39.5	122	18.9%	15.9–22.1				
Labor arrest (descent)	5	11.9%	4.0–25.6	160	24.8%	21.5–28.3				
Nonreassuring fetal tracing	25	59.5%	43.3–74.4	340	52.6%	48.7–56.5				
Preeclampsia/HELLP/eclampsia	1	2.4%	0.1–12.6	6	0.9%	0.3–2.0				
Malpresentation	0	0.0%	—	5	0.8%	0.3–1.8				
Maternal request	1	2.4%	0.1–12.6	13	2.0%	1.1–3.4				
Patients with prelabor/spontaneous labor	n=66			n=3118			cOR (95% CI)	*P* value	aOR (95% CI)	*P* value
Unscheduled cesarean deliveries	10	15.2%	8.7–23.7	232	7.4%	6.5–8.4	2.23 (1.12–4.42)	.022	1.78 (0.85–3.75)[a]	.126
Indications for unscheduled cesarean delivery after spontaneous labor										
Labor arrest (dilation)	1	10.0%	0.3–44.5	33	14.2%	10.0–19.4				
Labor arrest (descent)	1	10.0%	0.3–44.5	72	31.0%	25.1–37.4				
Nonreassuring fetal tracing	7	70.0%	34.8–93.3	118	50.9%	44.2–57.5				
Preeclampsia/HELLP/eclampsia	1	10.0%	0.3–44.5	1	0.4%	0.0–2.4				
Malpresentation	0	0.0%	—	5	2.2%	0.7–5.0				
Maternal request	0	0.0%	—	3	1.3%	0.3–3.7				
Patients with induction of labor (any method)	n=104			n=1797			cOR (95% CI)	*P* value	aOR (95% CI)	*P* value
Unscheduled cesarean deliveries	32	30.8%	22.1–40.6	414	23.0%	21.1–25.1	1.44 (0.93–2.22)	.095	1.47 (0.95–2.26)[b]	.08
Indications for unscheduled cesarean delivery after induction of labor										
Labor arrest (dilation)	9	28.1%	13.8–46.8	89	21.5%	17.6–25.8				
Labor arrest (descent)	4	12.5%	3.5–29.0	88	21.3%	17.4–25.5				
Nonreassuring fetal tracing	18	56.3%	37.7–73.6	222	53.6%	48.7–58.5				
Preeclampsia/HELLP/eclampsia	0	0.0%	—	5	1.2%	0.4–2.8				
Malpresentation	0	0.0%	—	0	0.0%	—				
Maternal request	1	3.1%	0.1–16.2	10	2.4%	1.2–4.4				

aOR, adjusted odds ratio; *CI*, confidence interval; *cOR*, crude odds ratio; *HELLP*, hemolysis, elevated liver enzymes, low platelet count; *TOL*, trial of labor (spontaneous labor or induction of labor).

[a] Model adjusted for potential funbalanced confounders between groups (pregestational diabetes mellitus, twin pregnancy, induction of labor); [b] Model adjusted for potential unbalanced confounders between groups (pregestational diabetes mellitus, twin pregnancy).

TABLE 3
Pregnancy and neonatal outcomes among nulliparas from 37 weeks' gestation by age group (≥40 or <40 years)

	≥40 y			<40 y		
	n=173			n=5038		
Outcomes	n	%	IQR	n	%	IQR
Pregnancy outcomes						
Gestational age at delivery (median)	40	39.34	39–40	40	39.54	39–40
	n	%	95% CI	n	%	95% CI
Vaginal delivery	128	74.0	66.8–80.4	4269	84.7	83.7–85.7
Spontaneous (among vaginal deliveries)	90	70.3	61.6–78.1	3413	80.0	78.7–81.1
Assisted (among vaginal deliveries)	38	29.7	21.9–38.4	856	20.1	18.9–21.3
Assisted vaginal delivery indication	38			856		
Nonreassuring fetal tracing	18	47.4	31.0–64.2	534	62.38	59.0–65.6
Labor arrest (descent)	20	52.6	35.8–69.0	317	37.03	33.8–40.4
Unknown	0	0.0	0.0–0.0	5	0.58	0.19–1.36
Type of anesthesia for emergency cesarean delivery	45			769		
Epidural	16	35.6	21.9–51.2	358	46.6	43.0–50.2
Spinal	23	51.1	35.7–66.4	332	43.2	39.6–46.8
General	6	13.3	5.1–26.8	79	10.3	8.2–12.6
Postpartum blood loss						
≤500 mL	141	81.5	74.9–87.0	4228	83.9	82.9–84.9
>500 and ≤1000 mL	18	10.4	6.3–15.9	493	9.8	9.0–10.6
>1000 and ≤1500 mL	7	4.1	1.6–8.2	118	2.3	1.9–2.8
>1500 mL	3	1.7	0.4–5.0	38	0.8	0.5–1.0
Missing blood loss	4	2.3	0.6–5.8	160	3.2	2.7–3.7
Postpartum blood loss among vaginal deliveries						
≤500 mL	112	87.5	48.8–78.1	3775	88.4	87.4–89.4
>500 and ≤1000 mL	8	6.3	11.2–37.1	308	7.2	6.5–8.0
>1000 and ≤1500 mL	5	3.9	0.5–15.1	94	2.2	1.8–2.7
>1500 mL	3	2.3	0.5–6.7	32	0.7	0.5–1.1
Missing blood loss	0	0.0	0	60	1.4	1.1–1.8

(continued)

TABLE 3
Pregnancy and neonatal outcomes among nulliparas from 37 weeks' gestation by age group (≥40 or <40 years) *(continued)*

	≥40 y			<40 y		
	n=173			n=5038		
Outcomes	n	%	IQR	n	%	IQR
Postpartum blood loss among cesarean deliveries						
≤500 mL	29	22.7	15.7–30.9	454	59.0	55.5–62.5
>500 and ≤1000 mL	10	7.8	3.8–13.9	185	24.1	21.1–27.2
>1000 and ≤1500 mL	2	1.6	0.2–5.5	24	3.1	2.0–4.6
>1500 mL	0	0.0	0–0	6	0.8	0.3–1.7
Missing blood loss	4	3.1	0.9–7.8	100	13.0	10.7–15.6
Neonatal outcomes						
Macrosomia						
>4000 g	6	3.5	1.3–7.4	270	5.4	4.8–6.0
Missing weight	5	2.9	0.9–6.6	81	1.6	1.3–2.0
Low birthweight[a]						
<10th percentile	16	9.3	5.4–14.6	362	7.2	6.5–7.9
<3rd percentile	9	5.2	2.4–9.6	110	2.2	1.8–2.6
Apgar score at 5 min						
<7	5	2.9	0.9–6.6	95	1.9	1.5–2.3
Missing Apgar score	9	5.2	2.4–9.6	140	2.8	2.3–3.3
NICU admission	9	5.2	2.4–9.6	116	2.3	1.9–2.8

CI, confidence interval; *IQR*, interquartile range; *NICU*, neonatal intensive care unit.

[a] 10th and 3rd percentile according to the INTERGROWTH-21st chart.

Braggion. Advanced maternal age among nulliparas at term and risk of unscheduled cesarean delivery. Am J Obstet Gynecol MFM 2023.

fetus is a reasonable decision when specific conditions are met.[18,19]

A cross-sectional study conducted in Japan investigated the risk of emergency cesarean delivery among nulliparas of different age groups.[17] The study reported that women aged 40 to 44 years were at higher risk of emergency cesarean delivery than women aged 30 to 34 years, with an adjusted risk ratio of 1.46 (95% CI, 1.40−1.5). Similarly, authors in Australia highlighted an association between AMA and the risk of emergency cesarean delivery.[15] In their analysis, the relative risk ratio was 2.21 (95% CI, 1.91−2.55) for patients aged ≥40 years. However, it is essential to note that their comparison group consisted of relatively young women aged 25 to 29 years, which may have influenced the results. In contrast, a study conducted in Spain did not report a significantly increased risk of emergency cesarean delivery for patients aged 40 to 44 years (aOR, 1.38; 95% CI, 1.18−1.61), but the increase in risk was more significant for women aged ≥45 years (aOR, 2.03; 95% CI, 1.50−2.74).[20]

Clinical implications

An explanation for the increased risk of unscheduled cesarean delivery among women aged ≥40 years is the potential decrease in the effectiveness of the uterus, and the associated labor dystocia. AMA may result in a less effective uterus because of poor contractility of the myometrium,[10,11,20] sclerotic lesions in uterine arteries,[11,20] and a reduced number of oxytocin receptors.[10,20] Poor placental perfusion among older women may lead to fetal distress and result in an emergency cesarean delivery.[21,22] Furthermore, the prevalence of chronic medical conditions may also contribute to the higher risk of emergency cesarean delivery among AMA patients.[10] Our results highlight that AMA constitutes a risk factor for unscheduled cesarean delivery and could provide valuable information for these women in understanding one of the factors potentially involved in this pregnancy outcome. Many women seek to comprehend why a cesarean delivery was necessary in their specific situation, and our findings may help address these questions. Further research is needed to elucidate why AMA is a risk factor for unscheduled cesarean delivery.

Strengths and limitations

One of the notable strengths of this analysis is the population of the study. Given that most women aged ≥40 years have typically given birth at least once, focusing solely on nulliparous patients provides specific insight into this particular group of women. In addition, patients' records were collected from a single tertiary-level center that follows standard, evidence-based practices, ensuring high-quality data. We also compared women aged ≥40 years with a group of a median age of 30 years (IQR, 27−33), which is higher than the median age reported in most studies. Several limitations need to be considered when interpreting the results of our analysis. Firstly, we lacked data on the medical history of patients, which can be more complex among those with AMA because of the increased likelihood of most chronic conditions. Preexisting diseases and pregnancy complications may also affect delivery outcomes and the risk of emergency cesarean delivery. Secondly, our data were collected from a tertiary university hospital, which could have led to selection bias because the center tends to receive and treat more severe cases. Thirdly, this study was conducted in a high-income country with high-quality medical services, and therefore the results may not be generalizable to low- or middle-income countries. In addition, no information was available regarding the follow-up of patients after delivery, including specific cesarean delivery complications such as organ lesions during the procedure (ie, bladder injury) or postcesarean infections, which are relevant clinical outcomes. Similarly, no detailed information was available regarding maternal and neonatal adverse outcomes following delivery, as described in the literature.[23]

Conclusion

Our study indicated that nulliparas aged ≥40 years have a higher likelihood of delivering by unscheduled cesarean delivery. This finding underscores the need for obstetricians to be aware of the increased risk and the importance of informing advanced-age women accordingly. However, we caution against overreliance on these results to make decisions about the mode of delivery. Instead, the results suggest that nulliparous patients aged over 40 years would benefit from receiving clear and dedicated information. ■

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.ajogmf.2023.100972.

References

1. Organization for Economic Co-operation and Development. Family database. Age of mothers at childbirth and age-specific fertility. 2022. Available at: https://www.oecd.org/els/soc/SF_2_3_Age_mothers_childbirth.pdf. Accessed June 5, 2022.
2. Ankarcrona V, Altman D, Wikström AK, Jacobsson B, Brismar Wendel S. Delivery outcome after trial of labor in nulliparous women 40 years or older-a nationwide population-based study. Acta Obstet Gynecol Scand 2019;98:1195–203.
3. Kortekaas JC, Kazemier BM, Keulen JKJ, et al. Risk of adverse pregnancy outcomes of late- and postterm pregnancies in advanced maternal age: a national cohort study. Acta Obstet Gynecol Scand 2020;99:1022–30.
4. Office federal de la statistique. Fécondité. 2022. Available at: https://www.bfs.admin.ch/bfs/fr/home/statistiken/bevoelkerung/geburten-todesfaelle/fruchtbarkeit.html. Accessed June 5, 2022.
5. Office fédéral de la statistique. Âge moyen des mères et des pères à la naissance de l'enfant selon la catégorie de nationalité, de 1971 à 2021 - 1971-2021. Available at: https://www.bfs.admin.ch/asset/fr/23328891. Accessed June 5, 2022.
6. Khalil A, Syngelaki A, Maiz N, Zinevich Y, Nicolaides KH. Maternal age and adverse pregnancy outcome: a cohort study. Ultrasound Obstet Gynecol 2013;42:634–43.
7. Laopaiboon M, Lumbiganon P, Intarut N, et al. Advanced maternal age and pregnancy outcomes: a multicountry assessment. BJOG 2014;121(Suppl1):49–56.
8. Sheen JJ, Wright JD, Goffman D, et al. Maternal age and risk for adverse outcomes. Am J Obstet Gynecol 2018;219:390.e1−15.

9. Londero AP, Rossetti E, Pittini C, Cagnacci A, Driul L. Maternal age and the risk of adverse pregnancy outcomes: a retrospective cohort study. BMC Pregnancy Childbirth 2019;19:261.
10. Bayrampour H, Heaman M. Advanced maternal age and the risk of cesarean birth: a systematic review. Birth 2010;37:219–26.
11. Herstad L, Klungsøyr K, Skjaerven R, et al. Maternal age and emergency operative deliveries at term: a population-based registry study among low-risk primiparous women. BJOG 2015;122:1642–51.
12. American College of Obstetricians and Gynecologists (College), Society for Maternal-Fetal Medicine, Caughey AB, Cahill AG, Guise JM, Rouse DJ. Safe prevention of the primary cesarean delivery. Am J Obstet Gynecol 2014;210:179–93.
13. Belfort MA. Overview of postpartum hemorrhage.UpToDate. 2022. Available at: https://www.uptodate.com/contents/overview-of-postpartum-hemorrhage. Accessed November 14, 2022.
14. Mikolajczyk RT, Zhang J, Betran AP, et al. A global reference for fetal-weight and birthweight percentiles. Lancet 2011;377:1855–61.
15. Ludford I, Scheil W, Tucker G, Grivell R. Pregnancy outcomes for nulliparous women of advanced maternal age in South Australia, 1998-2008. Aust N Z J Obstet Gynaecol 2012;52:235–41.
16. Kim SY, Park JY, Bak SE, et al. Effect of maternal age on emergency cesarean section. J Matern Fetal Neonatal Med 2020;33:3969–76.
17. Ogawa K, Urayama KY, Tanigaki S, et al. Association between very advanced maternal age and adverse pregnancy outcomes: a cross sectional Japanese study. BMC Pregnancy Childbirth 2017;17:349.
18. ACOG Committee Opinion No. 745: mode of term singleton breech delivery. Obstet Gynecol 2018;132:e60–3.
19. Griffiths M, Impey LWM, Murphy DJ, Penna LK. Management of Breech Presentation (Green-Top Guideline No. 20b). Royal College of Obstetricians and Gynaecologists; 2017. Available at: https://www.rcog.org.uk/guidance/browse-all-guidance/green-top-guidelines/management-of-breech-presentation-green-top-guideline-no-20b/. Accessed February 19, 2023.
20. Claramonte Nieto M, Meler Barrabes E, Garcia Martínez S, Gutiérrez Prat M, Serra Zantop B. Impact of aging on obstetric outcomes: defining advanced maternal age in Barcelona. BMC Pregnancy Childbirth 2019;19:342.
21. Torous VF, Roberts DJ. Placentas from women of advanced maternal age? Arch Pathol Lab Med 2020;144:1254–61.
22. Biagioni EM, May LE, Broskey NT. The impact of advanced maternal age on pregnancy and offspring health: a mechanistic role for placental angiogenic growth mediators. Placenta 2021;106:15–21.
23. Chauhan SP, Beydoun H, Hammad IA, et al. Indications for caesarean sections at ≥34 weeks among nulliparous women and differential composite maternal and neonatal morbidity. BJOG 2014;121:1395–402.

Author and article information

From the Materno-Fetal and Obstetrics Research Unit, Department Woman-Mother-Child, Lausanne University Hospital, Lausanne, Switzerland.

Received Feb. 26, 2023; revised Apr. 5, 2023; accepted Apr. 9, 2023.

A.B. and G.F. share first authorship.

The authors report no conflict of interest. All authors have completed the International Committee of Medical Journal Editors uniform disclosure form at www.icmje.org/coi_disclosure.pdf.

The authors report no funding for this study.

Data are available through joint research agreements from the corresponding authors.

Corresponding author: Guillaume Favre, MD. guillaume.favre@chuv.ch