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Original Research

Has advanced maternal age a real impact on intrapartum caesarean rate?

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Summary

Purpose: To analyze whether ≥ 40-year-old women have an increased risk of intrapartum caesarean delivery and perinatal complications compared to younger mothers. *Materials and Methods:* Retrospective data was collected on nulliparous women with no contraindications to vaginal delivery during a six-month period (n = 175). *Results:* ≥ 40-year-old pregnant women (n = 54) have a higher rate of intrapartum caesarean delivery, elective onset of labour, and gestational diabetes mellitus (GDM), compared to younger women. Newborns to younger mothers were heavier than those born to older mothers ($p = 0.037$), despite the fact that gestational age at delivery was similar for both groups. No statistically significant differences were seen regarding the incidence of hypertensive and growing disorders, instrumental delivery rate, dystocia, postpartum maternal complications, low Apgar scores at one and five minutes and arterial blood cord pH ≤ 7.10. *Conclusions:* ≥ 40-year-old women at delivery have an increased risk of intrapartum caesarean rate than younger women.

Key words: Advanced maternal age; Intrapartum caesarean section; Pregnancy; Neonatal; Complication.

Introduction

Maternal age is a main perinatal indicator [1]. Advanced maternal age (AMA) has traditionally been referred as ≥ 35-year-old pregnant women or older at the estimated date of delivery [1–4]. However, there is a trend to delay childbearing up to 40-years-old or later, especially in developed countries [1, 5–9].

Most authors suggest that maternal age is an independent risk factor for pregnancy and perinatal complications, such as gestational diabetes mellitus (GDM), hypertensive disorders, higher caesarean and instrumental delivery rates, as well as growth retardation and prematurity.

The majority of studies conclude that AMA is associated with a higher global caesarean rate. However, only a few have analyzed this rate focusing on its timing: elective or intrapartum [6]. Thus, the present authors aimed to analyze whether AMA pregnant women (considering ≥ 40-years-old patients) have an increased risk of intrapartum caesarean delivery and perinatal complications compared to younger mothers.

Materials and Methods

A retrospective cohort study was designed. The study group consisted of nulliparous women who were ≥ 40-years-old and delivered between June 1st, and December 31st, 2015. The control group included < 40-year-old nulliparous women who delivered between June 1st-31st, 2015. Gestational control and delivery were attended at a fourth-level obstetric center. The study met the center ethical criteria.

Inclusion criteria were singleton pregnancies in vertex presentation which were alive and delivered ≥ 34^{+0} weeks of gestation. Multiple pregnancies, previous uterine surgery, breech presentation, fetal death, fetal malformations, and any contraindication to vaginal delivery were exclusion criteria. Sample size is shown at Figure 1.

Gestational age (GA) at delivery was based on last menstrual period and confirmed by first-trimester ultrasound scan (crown-rump length, CRL*)*. In cases of IVF, GA was established from the date of embryo transfer. Hypertensive and amniotic fluid disorders were defined according to the American College of Obstetricians and Gynecologists (ACOG) criteria [10, 11]. GDM was diagnosed with a 100-gram oral glucose tolerance test when ≥ 2 values exceeded the Carpenter and Coustan criteria [12]. Small

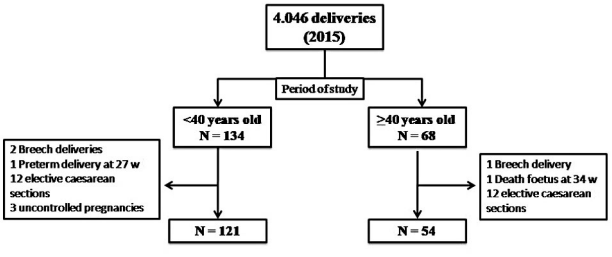

Figure 1. — Sample size.

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Table 1. — *Characteristics and obstetric history for the study and control groups.*

	Maternal age			
	< 40 years n = 121	≥ 40 years n = 54	*p*	OR (95% CI)
Maternal age*	32 (29-34)	41 (40-42)	–	–
Smoking	23 (19.0%)	8 (14.8%)	= 0.502	0.74 (0.31-1.78)
≥ 1 miscarriage	27 (22.3%)	24 (44.4%)	= 0.003	2.78 (1.40-5.53)
Endocrine disease	7 (26.9%)	9 (40.9%)	= 0.306	1.88 (0.56-6.33)
Caucasian race	106 (87.6%)	51 (94.4%)	= 0.280	2.41 (0.67-8.68)
Pregnancy weight gain ≥ 15 kg	36 (29.8%)	9 (16.7%)	= 0.067	0.47 (0.21-1.07)
BMI ≥ 30	9 (7.4%)	10 (18.5%)	= 0.030	2.83 (1.08-7.43)
ART pregnancy	6 (5%)	15 (27.8%)	< 0.001	7.37 (2.67-20.32)
- IVF	5 (83.3%)	15 (100%)	= 0.286	–
- Oocyte donation	0 (0%)	10 (66.7%)	= 0.033	–

*ART: assisted reproductive techniques; BMI: body mass index; IVF: in vitro fertilization. Categorical variables are given as n (%). Measure of association are expressed as OR (95%CI). *Quantitative variables are given as median + interquartile range.*

Table 2. — *Obstetric and perinatal outcome for the study and control groups.*

	Maternal age			
	< 40 years n = 121	≥ 40 years n = 54	*p*	OR (95% CI)
Pregnancy complications				
LGA	11 (9.1%)	9 (16.7%)	*p* = 0.146	2.00 (0.78-5.15)
SGA	5 (4.1%)	2 (3.7%)	*p* = 1.000	0.89 (0.17-4.75)
Polyhydramnios	4 (3.3%)	3 (5.6%)	*p* = 0.678	1.72 (0.37-7.97)
Oligohydramnios	4 (3.3%)	3 (5.6%)	*p* = 0.678	1.72 (0.37-7.97)
Hypertensive disorders	6 (5%)	3 (5.6%)	*p* = 1.000	1.13 (0.27-4.69)
Gestational diabetes	9 (7.4%)	12 (22.6%)	*p* = 0.005	3.56 (1.40-9.05)
Intrahepatic cholestasis	1 (0.8%)	1 (1.9%)	*p* = 0.523	2.26 (0.14-36.88)
Cervical shortening	1 (0.8%)	4 (7.4%)	*p* = 0.032	9.60 (1.05-88.04)
Mode of delivery				
Gestational age (weeks)	39.28 ± 1.37	39.20 ± 1.39	*p* = 0.732	–
Late prematurity (< 37 weeks)	4 (3.3%)	1 (1.9%)	*p* = 1.000	0.55 (0.06-5.06)
Elective onset of labour	45 (37.2%)	30 (55.6%)	*p* = 0.023	2.11 (1.10-4.05)
Intrapartum fever	39 (32.2%)	13 (24.1%)	*p* = 0.275	0.67 (0.32-1.38)
Meconium	2 (1.7%)	4 (7.4%)	*p* = 0.074	4.76 (0.84-26.83)
Caesarean delivery rate	13 (10.7%)	13 (24.1%)	*p* = 0.022	2.63 (1.13-6.15)
- Dystocia rate	10 (76.9%)	10 (76.9%)	*p* = 1.000	1.00 (0.16-6.20)
Intrumental delivery rate	38 (35.2%)	14 (34.1%)	*p* = 0.905	0.95 (0.45-2.04)
- Dystocia rate	34 (89.5%)	14 (100%)	*p* = 0.206	–
Maternal complications				
Postpartum hemorrhage	3 (2.5%)	2 (3.7%)	*p* = 0.645	1.51 (0.24-9.32)
Anemia (Hb < 8 g/dL)	1 (0.8%)	1 (1.9%)	*p* = 0.523	2.26 (0.14-36.88)
Blood transfusion	0 (0%)	1 (1.9%)	*p* = 0.309	–
Prolongued hospitalization	1 (0.8%)	1 (1.9%)	*p* = 0.523	2.26 (0.14-36.88)
Neonatal outcomes				
Neonatal weight*	3301 ± 500g	3134 ± 446g	*p* = 0.037	–
- < 2,500 grams	7 (5.8%)	6 (11.1%)	*p* = 0.215	2.04 (0.65-6.37)
- ≥ 4,000 grams	8 (6.6%)	0 (0%)	*p* = 0.060	–
Apgar score 1 minute < 7	7 (5.8%)	6 (11.3%)	*p* = 0.201	2.08 (0.66-6.51)
Apgar score 5 minute < 7	0 (0%)	0 (0%)	–	–
Arterial blood cord pH ≤ 7.10	2 (1.9%)	4 (9.1%)	*p* = 0.059	5.30 (0.93-30.07)
Congenital malformations	1 (0.8%)	1 (1.9%)	*p* = 0.523	2.26 (0.14-36.88)

*Hb: hemoglobine. LGA: large for gestational age; SGA: small for gestational age. Categorical variables are given as n (%). Measure of association are expressed as OR (95% CI). *Quantitative variables are given as mean ± standard deviation.*

for gestational age (SGA) or large for gestational age (LGA) were defined as estimated fetal weight by ultrasound below the 10th or above the 90th percentile for GA, respectively, regarding local population birthweight curves [13]. Cervical shortening criteria requiring intervention were sonographic cervical length < 25 mm at ≤ 31^{+6} weeks of gestation, or < 15 mm between 32^{+0}-34^{+6} weeks of gestation.

When elective onset of labour (EOL) was required and Bishop score was < 6, cervical ripening was used according to the present authors' protocols [14]. In case of no active phase of labour,

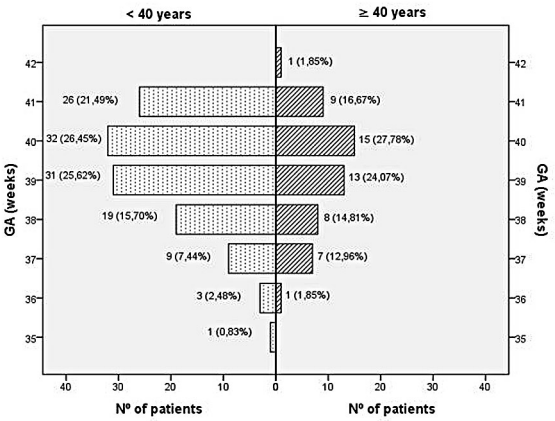

Figure 2. — Gestational age (GA) in weeks at delivery [n (%)] for the study and control groups.

or Bishop score ≥ 6, induction of labour with intravenous oxitocine was begun. Indications for caesarean or instrumental delivery were suspected fetal distress, due to anomalous cardiotocography, scalp blood test < 7.20 or other situation that implied a vital risk for the fetus, and dystocia (failed induction of labour, arrest of dilation or cephalopelvic disproportion in case of caesarean section, and arrest of descent in case of instrumental delivery) [15, 16].

Prolonged hospitalization was defined as more than four days after a vaginal delivery or more than seven days after a caesarean section. Postpartum hemorrhage was defined according to ACOG criteria, as well as blood transfusion indications [17]. Optimal values for umbilical cord arterial pH and five-minute Apgar score were considered ≥ 7.11 and ≥ 7, respectively [18, 19].

Normally distributed quantitative variables were expressed as mean and standard deviation. Non-normally distributed quantitative variables were expressed as median and interquartile range. Categorical variables were expressed as proportions.

Comparisons between age groups were done using the chi-square test or Fisher's exact test for categorical variables and Student *t*-test for quantitative variables. Multivariate analysis was performed using forward stepwise binary logistic regression. A probability value of < 0.05 was considered significant. Results are reported as proportions, odds ratio (OR), and 95% confidence interval (95% CI). Analysis was performed using the Statistical Package for the Social Sciences (SPSS version 21).

Results

The sociodemographic characteristics and obstetric history for the study and control groups are shown in Table 1. Previous miscarriage was more frequent in the study group [OR 2.78 (IC95% 1.40-5.53)]. The study group patients resorted to assisted reproductive techniques (ART) seven times more than those in the control group [OR 7.37 (IC95% 2.67-20.32)]. Obesity was twice more prevalent in ≥ 40-year-old pregnant women [OR 2.83 (IC95% 1.08-7.43)]. No statistically significant differences were seen regarding smoking, race, and pregnancy weight gain.

Obstetric and perinatal outcomes are shown in Table 2. The risk of developing GDM was three times higher in the study group [OR 3.56 (IC95% 1.40-9.05)], reaching up to 22.6%. Cervical shortening was more frequently diagnosed in ≥ 40-year-old pregnant women (7.4% and 0.8%, p = 0.032). Most of them presented premature uterine contractions, which required tocolytic treatment. If not, a cervical pessary was placed (two patients in the study group). There were no statistically significant differences regarding the incidence of hypertensive disorders, intrahepatic cholestasis, amniotic fluid, and fetal growing disorders.

Differences were observed between groups regarding the onset of labour and mode of delivery. The study group had a two-fold higher probability of having an EOL [OR 2.11 (IC95% 1.10-4.05)] and almost a three-fold higher probability of an intrapartum caesarean delivery [OR 2.63 (IC95% 1.13-6.15)] compared with younger women. The most frequent cause of EOL was premature rupture of membranes (22.2% and 10.7%, respectively).

As there were statistically significant differences between groups as to BMI, ART, and GDM, a second analysis was performed. When patients with high BMI or GDM were excluded, the OR obtained was non-significant 2.11 (p = 0.07). Also, a stepwise binary logistic regression multivariate analysis was performed including AMA, BMI, GDM, and ART. Only BMI > 30 remained as a variable in the equation.

No statistically significant differences were founded related to GA at delivery (Figure 2), prematurity, intrapartum fever, meconium-stained amniotic fluid, and instrumental delivery. In relation to the indication of the caesarean or instrumental delivery (labour dystocia or fetal distress), statistically significant differences were not detected. In addition, there were no differences between groups regarding maternal complications.

Newborns to younger mothers were heavier than those born to older mothers (3,301 and 3,134 grams, p = 0.037). Although no statistically significant difference was found, a tendency for a higher rate of birth weight < 2,500 grams (11.1% and 5.8%), one-minute Apgar score < 7 (11.3% and 5.8%) and umbilical cord arterial pH ≤ 7.10 was observed in the study group (9.1% and 1.9%). Also, a tendency for birth weight ≥ 4,000 grams in the control group was seen (p = 0.06). No newborn required to be transferred to the neonatal intensive care unit.

Discussion

Delayed childbearing has increased greatly in recent decades, especially in developed countries [3]. Some of the main reasons are female incorporation to working life, late emancipation and inflexible work schedules [2]. Also, ART advances have made possible to gestate at 5th and 6th decades of life.

Spain has one of the highest AMA at delivery rates in Europe (36.34% ≥ 35-years-old and 7.21% ≥ 40-years-old in

2014) (1, 20). This study focused on AMA women (≥ 40 years-old), since 35-39-year-old nulliparous women are the second most common age-group in the Spanish society (29.13% in 2014) [20].

Most studies analyze global caesarean rate [6]. Among those that focused on intrapartum caesarean delivery rates, there seems to be a consensus concerning the fact that AMA is related with higher rates compared to younger pregnant women [4, 6, 7, 21, 22], as shown in the present study. However, most authors agree on the more permissive indications to perform a caesarean section [2, 5-7], which could excessively increase the rate in AMA women.

As some investigators did [6, 21, 22], the present authors found a statistical significance between AMA and elective labour induction [OR 2.11 (IC 95% 1.10-4.05)]. Bearing in mind that bibliography refers to EOL as a risk factor for caesarean section [14], it could be suggested that the higher rate of caesarean section in AMA pregnant women may be due, at least partially, to the higher rate of EOL.

Other explanations could be either an impaired contractile function of myometrium or uteroplacental insufficiency. Nevertheless, no statistically significant differences were found between groups with regards to the indication (dystocia or fetal distress) for both caesarean delivery [4, 6] and instrumental delivery. Caesarean section due to maternal request or maternal age is not taken into account in the present center, in contrast to others [2, 5-7]. Respecting the rate of instrumental delivery, statistically significant differences were not found between groups [4, 6], but there is no agreement [3, 7, 8].

Scientific consensus exists for the higher risk that AMA women have to develop GDM [2, 5, 7, 8, 23]. On the other hand, the association between AMA pregnants with hypertensive [5, 23] and growing disorders [2, 4, 23], postpartum hemorrhage [2, 7, 8], as well as prolonged postpartum hospitalization [2, 5, 7] generates debate among authors.

One of the main causes for perinatal morbi-mortality is prematurity, and most authors have described an increased incidence in AMA pregnancies [2, 7, 8, 23]. However, this study hardly evaluated its incidence due to its gestational age exclusion criterion. According to the present results, some authors conclude that young pregnant women have heavier newborns [2, 23]. On the other hand, Adashek *et al.* [4] obtained an opposite result. Statistically significant differences have not been described with respect to either Apgar score at one and five minutes [4, 7] or umbilical cord arterial pH [4]. However, the present authors found a tendency for a higher rate of pH ≤ 7.10 among AMA pregnancies.

This study focused on the intrapartum caesarean rate as the main outcome. It is important to highlight the heterogeneity between studies, some of which include multiparous women [2, 5, 7, 8, 22] and multiple gestations [2] that may be considered as a bias, excluding the one of Bell *et al.* [6]. Also, it is a one-center study with a protocol management of delivery and strict inclusion and exclusion criteria, and data was collected by a single scientist. Nonetheless, the retrospective design and the sample size are the main limits of this study. In addition, the higher prevalence of obesity in the study group appeared to act as a confounding factor as previously stated, as it may be partly responsible for the higher incidence of GDM, and both of them for the higher intrapartum caesarean rate, among other perinatal adverse outcomes.

Conclusion

Pregnancy at advanced maternal age has been linked to poor obstetric and neonatal outcomes. The present findings might shed some more light on this line and provide accurate information to AMA pregnant women about maternal and perinatal outcomes. Further investigation is needed regarding the effect of maternal age on pregnancy outcome.

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