

Original Research

High Cesarean Section Rates during Labor Induction in Low Risk, Late-Term Cephalic Pregnancies in a Tertiary Centre

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Abstract

Background: The cesarean section rate is high in countries such as Türkiye, Egypt, and Brazil. The aims of this study were to determine whether the cesarean section rate during labor induction is high in late-term cephalic pregnancies and to evaluate the related factors.

Methods: This retrospective descriptive study was conducted with 254 patients with a cephalic fetal presentation who were admitted in the labor unit of a tertiary center for induction of labor (IOL) at ≥ 41 0/7 weeks of gestation. The patients were evaluated in terms of demographic characteristics, Bishop score, labor induction method (dinoprostone or oxytocin administration), IOL duration, vaginal delivery rate, cesarean section rate, indication for cesarean delivery, 5-min Apgar score, fetal requirement for neonatal resuscitation, oxygen treatment, and neonatal intensive care unit admission. **Results:** The study population comprised 254 patients, of whom 181 (71.3%) had a vaginal delivery and 73 (28.7%) had a cesarean delivery. To evaluate the factors that affect labor induction failure and cesarean indication, the patients were divided into two groups: the nulliparous (n: 122) and multiparous (n: 132). The cesarean section rates in the nulliparous and multiparous groups were 44.3% (n: 54/122) and 14.4% (n: 19/132), respectively. According to the multivariate logistic regression, being nulliparous, having a male fetus were found to be the associated risk factors for cesarean delivery ($p < 0.05$).

Conclusions: The study results suggest that the cesarean section rate during labor induction is higher in low-risk, late-term cephalic pregnancies. Nulliparity, male fetal sex were risk factors for cesarean delivery.

Keywords: cesarean section; induced labor; late-term pregnancies; parity

1. Introduction

Full-term pregnancy is defined as a gestational age of 39 to 41 weeks; late-term pregnancy, as a gestational age of 41 to 42 weeks; and post-term pregnancy, as a gestational age of ≥ 42 weeks [1]. In pregnancies without any defined risk factors (low-risk pregnancy), delivery does not occur spontaneously at term or at gestation. When gestation is prolonged after a full-term pregnancy, perinatal morbidity and mortality rates increase [2,3]. Thus, obstetricians recommend delivery with induction of labor (IOL) to reduce the risks of fetal morbidity and mortality. However, no consensus has been reached on the optimal timing to initiate IOL in term or post-term pregnancies [4,5]. Previous studies have suggested that IOL during late-term pregnancy decreases the risks of fetal and maternal morbidity compared with IOL during post-term pregnancy [5,6].

The cesarean section (CS) rate is increasing worldwide, with one in three women in the United States and four in five women in some regions of the world having undergone CS [7]. CS rates are higher in Türkiye, Egypt, and Brazil than in other countries. Many factors affect obstetricians' decision to perform CS, such as the patient's desire to have CS or noncompliance during labor, health laws, and defensive medicine. On the basis of data from the years 2021 and 2022, the CS and primary CS rates in live births in Türkiye were 58.4% and 57.6%, and 29.1% and 29.8%, respectively [8,9]. However, CS is associated with mater-

nal morbidities and a high cost and economic burden on the health system [7]. Thus, we conducted this study to determine whether the CS rate in late-term pregnancy was high in women with a cephalic fetal presentation and to identify the factors associated with the CS rate in a tertiary hospital in Türkiye.

2. Materials and Methods

2.1 Study Design and Participants

This retrospective descriptive study was conducted at the Antalya Training and Research Hospital. A total of 254 women who were admitted for IOL in the labor unit of the hospital at ≥ 41 0/7 weeks of gestation between April 2022 and September 2022 were included in the study. The study data were obtained from the patients' hospital records. All procedures were performed in accordance with the ethical standards of the responsible (institutional and national) committee on human experimentation and the 1975 Declaration of Helsinki, as revised in 2008. Ethics committee approval has been granted from our institution in 2022 with protocol number 318, and informed consent has been obtained from all participants.

The inclusion criteria were as follows: (1) women with a cephalic fetal presentation. (2) Women with low-risk pregnancies. (3) Women with late-term (gestational age of ≥ 41 0/7 weeks) pregnancies.



The exclusion criteria were as follows: (1) women with high-risk pregnancies, such as those with preeclampsia, gestational diabetes mellitus, intrauterine growth retardation. (2) Estimated fetal weight >4500 g. (3) Fetuses with congenital anomalies.

2.2 Data Collection and Procedures

The patients' demographic characteristics, gestational ages, cervical Bishop scores (BS) at admission, medication for IOL (either dinoprostone [Propess, Ferring, Türkiye] or oxytocin [Synpitan Forte 5 IU/mL intravenous/intramuscular ampoule, Istanbul, Türkiye]), IOL durations, vaginal delivery rate, CS rate, indications for cesarean delivery, neonatal outcomes, 5-min Apgar score, requirement for neonatal resuscitation intervention, fetal oxygen treatment, and neonatal intensive care unit admission rate were evaluated.

Cervical ripening was evaluated on the basis of the BS that evaluates several clinical parameters of the cervix, including dilation, effacement, position, consistency, and the fetal head's station in the pelvis at admission. Each parameter is assigned a score, with the total score ranging from 0 to 13 [10]. When the cervical BS was <5, a 10 mg dinoprostone vaginal ovule was inserted in the vagina to achieve cervical ripening, as described by Wheeler *et al.* [11]. After achieving efficient cervical dilatation of ≥ 4 cm or 24 h after dinoprostone administration, the IOL medication was discontinued. Intravenous administration of 10 U oxytocin infusion in 1 L of serum physiologic was initiated at 4 drops/min 1 h after the last dinoprostone ovule was administered. The oxytocin infusion rate was gradually increased every 20 min to 4 drops/min to achieve effective uterine contraction. When the patient had a BS > 5 at the initial vaginal examination, IOL was initiated with oxytocin infusion. The induction duration was defined as the time interval between the beginning of the oxytocin infusion and the fetal delivery.

Apgar score is a scoring system provided a standardized assessment for infants after delivery. The score is reported at 1 minute and 5 minutes after birth for all infants. The Apgar score comprises 5 components: (1) color; (2) heart rate; (3) reflexes; (4) muscle tone; and (5) respiration. Each of these components is given a score of 0, 1, or 2 [12,13].

2.3 Statistical Analysis

Patients' data were analyzed with the IBM Statistical Package for the Social Sciences (SPSS) for Windows 23.0 (IBM Corp., Armonk, NY, USA) package program. Categorical data were elaborated with frequency and percentage, and numerical data were shown with median, minimum, and maximum descriptive values. The normality test of the data was performed with the Kolmogorov-Smirnov Test. In the comparisons between the groups "Chi-Square Test" was used for the comparison of categorical variables. Logistic Regression Analysis was used to examine the risk

factors affecting cesarean delivery. The results were considered statistically significant when the p -value was less than 0.05.

3. Results

3.1 Participant Characteristics

Data from 254 patients were included in the study. The patients were divided into two subgroups, one including nulliparous women (n: 122, 48%) and the other including multiparous women (n: 132, 52%), to obtain detailed information for evaluating the outcome of IOL and type of delivery (vaginal or CS). The groups' descriptive features, including age, body mass index (BMI), gravidity, parity, number of previous live deliveries, BS, labor-inducing drug, IOL duration, mode of delivery, and CS indication, are presented in Table 1. Dinoprostone is usually chosen for IOL in nulliparous patients with low BS; and oxytocin for multiparous patients because it does not require cervical ripening [11]. Of the patients included in the study, 181 (71.3%) had a vaginal delivery and 73 (28.7%) had a cesarean delivery. The CS rate was 44.3% (n: 54/122) in the nulliparous patients and 14.4% (n: 19/132) in the multiparous patients. In the study, indications for CS were fetal distress (60.3%) (n: 44/73), cephalopelvic disproportion (9.6%) (n: 7/73), and non-progressing labor (30.1%) (n: 22/73).

3.2 Fetus Characteristics

The characteristics of the patients' infants, including birth weight, fetal sex, 5-min Apgar score, and fetuses requiring intervention (oxygen treatment, fetal resuscitation, or admission to the neonatal intensive care unit), are presented in Table 2.

When the infants' birth weights were examined according to sex, the male infants were heavier (median [range]: 3540 g [2690–4500 g]) than the female infants (3360 g [2490–4300 g]), with a statistically significant difference ($p < 0.001$) (Table 3).

3.3 Logistic Regression Analysis of the Factors that Increased the CS Rate

The factors that increased the CS rate in the patient groups were evaluated using a logistic regression analysis (Table 4). The primiparous patients were 4.76 times more likely than the multiparous patients to give birth via CS. The risk of cesarean delivery increased with gravidity (1.52 times), parity (2.08 times), BS < 5 (1.49 times), and initial treatment with dinoprostone (3.7 times). Having a male fetus increased the risk of cesarean delivery by 2.17 times compared with having a female fetus. When the significant variables in the univariate model were reevaluated in the multivariate model, primiparous and fetal sex remained statistically significant. The results indicate that primiparous women are 4.35 times more likely than multiparous women to give birth via CS. Initial treatment with dinoprostone increased the CS rate 2 times more than oxytocin treatment

Table 1. Demonstrates demographic and clinical characteristics of patients.

Variables	Total	Primiparous	Multiparous	Test	p-value
	(n = 254)	(n = 122)	(n = 132)		
	n (%) or median (Min–Max)	n (%) or median (Min–Max)	n (%) or median (Min–Max)		
Age (years)	26 (17–43)	24 (17–43)	28 (18–41)	Z = –5.998	<0.001
BMI (kg/m ²)	27.1 (22.0–41.6)	26.6 (22.1–41.6)	28.1 (22.0–40.7)	Z = –4.265	<0.001
Prior late term	3 (1–2)	0 (0)	3 (2.3)	$\chi^2 = 1.196$	0.274
Bishop score	0 (0–4)	0 (0–4)	0 (0–4)	Z = –1.120	0.263
Duration of induction (hour)	9.2 (0.6–48.0)	11.3 (0.7–48.0)	7.6 (0.6–32.5)	Z = –4.633	<0.001
Induction drug				$\chi^2 = 42.267$	<0.001
Oxytocin	137 (53.9)	40 (32.7)	97 (73.4)		
Dinoprostone	117 (46.0)	82 (67.2)	35 (26.5)		
Delivery mode				$\chi^2 = 27.618$	<0.001
Vaginal delivery	181 (71.3)	68 (55.7)	113 (85.6)		
Cesarean section	73 (28.7)	54 (44.3)	19 (14.4)		
CS indication					
CPD	7 (9.6)	4 (7.4)	3 (15.8)		
Fetal distress	44 (60.3)	32 (59.3)	12 (63.2)		
Non-progressing labor	22 (30.1)	18 (33.3)	4 (21.0)		

BMI, body mass index; CPD, cephalopelvic disproportion; CS, cesarean section; Min, minimum; Max, maximum.

Table 2. Shows fetal demographic and clinical characteristics of the fetus.

Variables	Total	Primiparous	Multiparous	Test	p-value
	(n = 254)	(n = 122)	(n = 132)		
Birth weight (g) (median. Min–Max)	3450 (2490–4500)	3410 (2700–4500)	3455 (2490–4320)	Z = –1.041	0.298
5th minute Apgar score (median. Min–Max)	10 (5–10)	10 (5–10)	10 (7–10)	Z = –1.578	0.115
Gender				$\chi^2 = 2.912$	0.088
Male (n, %)	115 (45.3)	62 (50.8)	53 (40.2)		
Female (n, %)	139 (54.7)	60 (49.2)	79 (59.8)		
NICU admission (n, %)	18 (7.1)	11 (9)	7 (5.3)	$\chi^2 = 1.328$	0.249
Oxygen treatment (n, %)	21 (8.3)	12 (9.8)	9 (6.8)	$\chi^2 = 0.761$	0.383
Fetal resuscitation (n, %)	13 (5.1)	8 (6.6)	5 (3.8)	$\chi^2 = 1.001$	0.317

NICU, neonatal intensive care unit; Min, minimum; Max, maximum.

Table 3. Infants' birth weights according to sex.

Variable	(N = 254)	Test	p-value
	Median (Min–Max)		
Gender		Z = –3.657	<0.001
Male	3540 (2690–4500)		
Female	3360 (2490–4300)		

Min, minimum; Max, maximum.

did. Having a male fetus increased the CS rate 2 times more than having a female fetus.

4. Discussion

The results showed that the total CS rate was 28.7% in the late-term pregnancies, which was lower than the annual national CS rate of 57.6%. The CS rate among the nulliparous women with late-term pregnancies was higher (44.3%) than the national primary CS rate (29.8%) [9]. The multivariate analyses revealed that being nulliparous and male fetal sex were associated with the increased CS rate.

Having a prior vaginal delivery is known to enhance the likelihood of a later vaginal delivery, which explains why the CS rate was higher in the nulliparous women. Since the caesarean section rate will be higher in nulliparous than in multiparous, we think that it will not be meaningful to compare the CS rates and CS indications. A low BS indicates inefficient cervical ripening, which explains why the CS rate was higher in the pregnant women who received dinoprostone for cervical ripening before oxytocin administration.

IOL is a common practice that can also interfere with the natural processes of pregnancy and childbirth. It is often painful for women and may require epidural analgesia or operative delivery [14]. According to maternal and perinatal health data from the World Health Organization (WHO), based on approximately 300,000 births in 24 countries, IOL is performed in approximately 9.6% of deliveries. The IOL rates tend to be lower in African countries than in Asian and Latin American countries and generally higher in developed countries than in developing countries

Table 4. Demonstrate associated factor that increase cesarean section delivery between groups.

Variables	Univariate		Multivariate	
	Odds ratio (95% CI)	p-value	Odds ratio (95% CI)	p-value
Groups				
Multiparous (n = 132)	References	-	References	-
Primiparous (n = 122)	4.76 (2.56–8.33)	<0.001	4.35 (1.35–14.3)	0.013
Gravida	1.52 (1.16–1.96)	0.002	0.95 (0.63–1.43)	0.812
Parity	2.08 (1.45–2.94)	<0.001	0.97 (0.45–2.08)	0.935
Bishop score	1.49 (1.04–2.13)	0.028	1.22 (0.84–1.79)	0.293
Initial drug				
Oxytocin	References	-	References	-
Propress	3.70 (2.07–6.60)	<0.001	2.00 (1.00–3.97)	0.050
Fetal gender				
Female	References	-	References	-
Male	2.17 (1.25–3.70)	0.006	2.00 (1.09–3.70)	0.025

95% CI, 95% confidence interval.

[15]. While IOL may be necessary in certain high-risk situations, it is an independent risk factor for complications that can increase the risk of fetal and maternal morbidities and mortality [16]. In studies that evaluated the risks in late- and post-term pregnancies, primiparous women have been found to have a higher risk than multiparous women [17,18]. Furthermore, in a cohort study that compared maternal and perinatal risks according to gestational age, the adverse risks of both maternal and fetal morbidities were higher in nulliparous women than in multiparous women [19]. The results of the present study support those of previous studies that indicated that nulliparous women have a higher CS rate (44.3%), which represents fetal and maternal morbidities.

No information has been reported on the effect of fetal sex on post-term pregnancies. A recent study concluded that fetal sex did not have a significant effect on post-term pregnancy [2]. In our study, the proportion of male fetuses (45.3%) was lower than that of female fetuses (54.7%). However, having a male fetus increased the CS rate by twofold compared with having a female fetus, which could be attributed to differences in birth weight between male and female fetuses.

Late- and post-term pregnancies are associated with increased maternal morbidity, neonatal morbidity, and mortality [18,20]. The main concern in late- and post-term pregnancies is the increased risk of intrauterine fetal death [5]. The perinatal mortality rate increases from 0.7% to 5.8% as the gestational age increases to between 37 0/7 and 43 6/7 weeks [21]. The fetal and neonatal complications in late- and post-term pregnancies include macrosomia, meconium aspiration, hypoxia due to placental insufficiency, asphyxia, oligohydramnios with related morbidity, and a low Apgar score [18,22–25]. Postmaturity syndrome has been observed in approximately 20% of post-term pregnancies. Macrosomia is defined as a birth weight >4000 g, and its incidence rate increases in post-term pregnancies, which leads to increases in CS and fetal and maternal mor-

bidity rates [23,25]. In our clinic, fetuses with an estimated weight >4000 g during prenatal visits were delivered via CS. Hence, the incidence rates of fetal and maternal morbidities due to macrosomia in the present study were very low. In addition, operative vaginal delivery is not usually performed in our clinic because of the risk of complications and legal issues. Thus, we prefer cesarean delivery over operative vaginal delivery, which explains the higher CS rate in our clinic.

Keulen *et al.* [26] reported that the CS rate in late-term pregnancy was 10.1% in a high-population (n: 1801) study. The CS rate in our study was 28.7%, much higher than that in their rate. Keulen *et al.* [26] also reported an operative delivery rate of approximately 10.0%. However, none of the women in our study had an operative vaginal delivery because CS is generally preferred to operative vaginal delivery in Türkiye, which explains the higher CS rate in our study than in those in other countries. Ranjbar *et al.* [27] reported a cesarean rate of 27.7% and an operative vaginal delivery rate of 1.3%. The fetal distress rate in their study was 82.0%, which is higher than that in our study (60.2%). The results of the previous and present studies are similar and suggest that patients and physicians from similar geographical regions have similar characteristics and attitudes toward the mode of labor induction.

The fact that this study was conducted at a single tertiary center represents an important limitation. However, we think that there is no risk of bias in the study because the study is retrospective and the treatments and procedures given to the patients in the delivery room are performed by different teams, not just a single physician.

Recent studies have indicated that the CS rate is higher in post-term than in term pregnancies [28,29]. This finding suggests that both physicians and pregnant women have the intention for CS, as also demonstrated in our study. In our study, we tried to reveal that even if labor induction is applied in late-term pregnancies, our CS rate is still high and the factors affecting the high CS rate. We think that it will

help future studies and may guide clinicians working to reduce cesarean section rates in clinics.

5. Conclusions

On the basis of the findings of this study, nulliparity, and male fetal sex were associated with an increased CS rate. These factors influence obstetricians' decision-making process regarding the mode of delivery in late- and post-term pregnancies. The high CS rate in late-term cephalic pregnancies may be attributed to the aim of avoiding maternal and fetal morbidities. Further research is required to enhance our understanding and effective management of late- and post-term pregnancies.

Availability of Data and Materials

The datasets analyzed in the present study are available from the corresponding author upon reasonable request.

Author Contributions

NE and MK designed the study. NE, MK, YAM, and FEIE performed the experiments. NE and MK analyzed the data. NE and MK prepared the manuscript. All authors contributed to the editorial changes in the manuscript. All authors read and approved the final version of the manuscript. All authors have participated sufficiently in the work, and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

All subjects gave their informed consent for inclusion before they participated in the study. This study was conducted in accordance with the 1975 Declaration of Helsinki, as revised in 2008. It was approved by the ethics committee of Antalya Training and Research Hospital in 2022 (protocol No. 318).

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Conflict of Interest

The authors declare no conflict of interest.

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