# Risks and Indications for Cesarean Sections in Primiparous Women: A Case-control Study

**Abstract**
**Objective:** To determine the indications and risks for cesarean section (CS) among primiparous women**. Methods:** This register-based study was conducted from January to December 2011, at the Maternity and Children's Hospital, Buraidah, Saudi Arabia. The total number of primiparous women who delivered during the study period was 1146. Of the 367 who delivered by CS, 13multiple pregnancies were excluded from the study. The remaining 354 women that comprised the study group were compared with 354 primiparous women who had delivered vaginally during the same period (control group). Logistic regression analysis was used to compare selected variables for the risk of CS. **Results:** Of the total 1146 primiparous women who had delivered during the study period, 32% (n = 367) underwent CS, with most (71.7%, n = 263) undergoing an emergency CS. Common indications for CS were fetal distress (30%, n = 110), breech presentation (19.3%, n = 71), failure of labor progression (18.8%, n = 69), and failure to induce labor (11.7%, n = 43). Logistic regression analysis showed that the rate of CS increased significantly in association with lower maternal age (OR = 1.868, 95% CI = 1383–2.523, $p < 0.0001$) and a fetal weight of ≥4 kg (OR = 3.491, 95% CI = 2.082–5.854, $p < 0.0001$). No fetal or maternal mortality was reported. **Conclusion:** This study shows that the CSR is increasing. Common indications for CS were fetal distress, breech presentation in labor, failed induction of labor, and failure to progress. This increase in the CSR was significantly associated with younger maternal age (≤22 years) and a fetal birth weight ≥4 kg.

**Keywords: primipara, cesarean section, cesarean delivery, risks factors, pregnancy outcome**

## Introduction

The worldwide increase in the cesarean section rate (CSR) is a global concern. This increase has prompted the World Health Organization (WHO) to advocate that the CSR should not exceed 15% [1]. Increases in the numbers of primary cesarean sections (CSs) and unsuccessful vaginal births after a previous CS are thought to have contributed to the increase in the CSR [2-4]. Reports from Saudi Arabia have shown that the CSR is increasing rapidly [5]. In Saudi Arabia, the growth rate is 3.5% per year, and the total fertility rate is 7.1 births per woman, which places Saudi Arabia among the countries with the highest fertility rate [6]. In addition to the known risk factors for CS, social and cultural beliefs advocate for marriage at an early age, which is very common in Saudi Arabia, and this may lead to increases in the CSR. Furthermore, cultural beliefs encourage large families in Saudi Arabia, and this could further exacerbate increases in the CSR and the complications associated with CS. Given that CS is associated with short- and long-term adverse effects, strategies to reduce CSR are mandatory. This goal is achievable by reducing the risk factors for primary CSR, and thus, the associated complications. The aim of this study was to determine the indications and risks factors for CS in primiparous women over a 1-year period in the Al-Qassim Region of Saudi Arabia.

## Methods and subjects

For this retrospective case-control study, we reviewed the records of 9241 gravidas who delivered at the Maternity and Children's Hospital (MCH), Buraidah, Qassim Region, Kingdom of Saudi Arabia from January 1, 2011 to December 13, 2011. Data were obtained from the registry section of a computerized dataset. This study was approved by the Ethics Committee of the College of Medicine of Qassim University.

Of the 9241 gravidas, 1146 primiparous women delivered during the study period. For this study, primipara was defined as a woman who had delivered for the first time at or after 24 weeks of gestation. Of the 1146 primiparous women, 367 had delivered by CS, of which 13 twin pregnancies were excluded from the study. The remaining 354 singleton pregnancies comprised the study group. They were matched to 354 primiparous women who had delivered vaginally during the study period (control group), who randomly selected during the same period. The groups were compared for pregnancy outcomes and risks for CS.

Demographic data, including maternal age, parity, and weight, were recorded. All women in this study received regular, free antenatal care at the MCH. Women in labor were monitored using cardiotocography (CTG), either continuously or intermittently, depending on fetal status. In most cases, the fetal heart rate was assessed continuously. CTG outputs that showed repetitive late decelerations or deep variable decelerations (<80 beats per min) indicated the requirement of CS [7].

Outcomes assessed included indications for CS, and maternal and fetal complications. Maternal complications included pre-eclampsia, diabetes mellitus (DM), and antepartum hemorrhage (APH). Postnatal complications included the mode of delivery, postpartum hemorrhage (PPH), deep vein thrombosis (DVT), and maternal injuries. The record-reported fetal outcomes included fetal distress (when the infant's condition necessitates admission to the intensive care unit), Apgar scores, malformations, gestational age at delivery, and fetal birth weight.

For simplicity, DM included both preexisting and gestational diabetes. PPH was diagnosed when blood loss exceeded 1000 mL for CS and 500 mL for vaginal deliveries. Because of difficulties in collating the pH values of umbilical cord blood from the registry, these values were not analyzed as part of the study. Elective CS was performed in accordance with departmental policy when a primigravida had a breech presentation. Labor was induced in women with diabetes and pregnancy-induced hypertension (PIH) after 38 weeks of gestation.

The study population was categorized into 2 groups according to age, and hence, according to pelvic maturation as follows: ≤22 years and >22 years(reference group).

The Statistical Package for the Social Sciences for Windows, version 15 (SPSS Inc., Chicago, Illinois) was used to record data and for analyses. The descriptive analyses used included the mean, standard deviation, and frequency distribution. The chi-square test was used to compare the categorical data, and Student's *t*-test was used to compare the means of the quantitative data. For logistic regression using multivariate analysis, independent variables were added to the model at the same time, whereas in the univariate analysis, each variable was entered separately. The results of the analysis are presented as odds ratios (ORs) and 95% confidence intervals (95% CIs). A p value <0.05 was considered significant.

## Results

The total number of primiparous women during the study year was 1146. Of these, 367 underwent CS; thus, the incidence of CS among primiparous women was 32% during the study year.

The mean maternal ages for the CS group and the control group were (23.5169 ± 3.98382 years vs. 22.4550 ± 2.69837 years, respectively, p < 0.0001). There were significant differences between the CS and control groups with respect to gestational age at delivery (38.6299 ± 2.66576 weeks vs. 39.3125 ± 2.66576 weeks, respectively, p < 0.0001), fetal birth weight (3.0450 ± 0.59156 kg vs. 3.2745 ± 0.24072 kg, respectively, p < 0.0001), and the Apgar score (7.7684 ± 1.19845 vs. 8.3200 ± 0.80263, respectively, p < 0.0001).

The most common indications for CS were fetal distress (30%, n = 110) and breech presentation in labor (19.3%, n = 71). Failure of progress was an indication in 18.8% (n = 69) of the cases, whereas failure of induction of labor accounted for 11.7% (n = 43) of the CS cases. Less common indications for CS are presented in Fig. 1.

Comparisons of maternal and perinatal outcomes between primiparous women in the CS and control groups are shown in Table 1. Compared with women who had vaginal deliveries, those who delivered by CS had a significantly higher incidence of PIH, premature rupture of membranes (PROM), and incidence of medical problems, and their infants had a higher rate of admission to the neonatal intensive care unit (NICU) (p < 0.05). Other complications, including PPH, DVT, DM, PROM, and fetal malformations, were of similar frequency in both groups (p > 0.05).

Univariate and multivariate analyses of the selected risks for CS in this study population showed that the risk for CS was significantly higher with decrease in maternal age (OR = 1.868, 95% CI = 1.383–2.523, p < 0.0001) and increase in fetal birth weight (OR,3.491; 95%

CI,2.082–5.854; $p < 0.0001$). Logistic regression analyses demonstrated that CSR did not significantly increase in the presence of PIH and diabetes, as shown in Table 2.

**Discussion**

The CSR among primiparous women in the current study was 32%. Comparing this CSR with that published previously suggests a sharp increase in the CSR over a short period. The increase in the CSR was more rapid in 2006 when it was 19.1%, compared with the first time period in 1997 when it was 10.6% (published national data) [5]. In 2003, Sobande et al. reported a CSR of 19.4% among primiparous women in Saudi Arabia in a 3-year study from 1997 to 1999 [9].

The increase in the CSR among primiparous women has been attributed to improvements in the health care system in Saudi Arabia [5]. We believe that marriage and pregnancy at an early age may also be important contributory factors to this increase. In this study, the mean maternal age of the group who delivered by CS was 23.5169 ± 3.98382 years, and 22.9% of the study subjects were <20 years of age. This means that they became pregnant before the pelvis had matured, resulting in fetopelvic disproportion, which plays an important role in dysfunctional labor. It has been reported that the increase in CSR is not associated with improvements in neonatal outcomes [8], indicating an unjustified increase in CSR. This supports the CSR advocated by WHO (5–15%) for optimal fetal and maternal outcomes.

The relative contributions of each indication to the increase in CSR in the current study were as follows: fetal distress, 30% (n = 110); breech presentation in labor, 19.3% (n = 71); arrest disorders without fetal distress, 18.8% (n = 69); and failed induction of labor, 11.7% (n = 43). Collectively, these indications accounted for an increase of approximately 80% in the CSR. Our results are similar to previously published data in which fetal distress and dystocia were the leading indications for higher CSRs [9, 10]. Fetal distress is diagnosed based on CTG findings. However, several studies have demonstrated inter-observer errors in the interpretation of CTG outputs. Further, CTG is reported to have a low specificity for fetal acidosis during delivery [11]. The threat of lawsuits may be one reason for a high threshold for performing CS. Absolute indications for CS are few, with the majority of being subjective. However, reducing the CSR in the current medicolegal environment will not be straightforward.

Regarding maternal and perinatal outcomes, PIH, PROM, and the frequency of admission to NICU were significantly higher in the CS group. PROM is associated with an increased CSR [12]. PROM may an early warning sign of fetopelvic disproportion and should be anticipated in primiparous women. PROM may be associated with or result from ascending infection, and during CS after PROM, bacterial colonization has been reported in the amniotic fluid of 44.3% of patients [13]. This high incidence of infection may be responsible for the high rate of NICU admission among infants delivered through CS.

This study indicated that the CSR increases by 1.4-fold when maternal age is ≤22 years and by 2-fold when the fetal birth weight is ≥4 kg. Our results agree with those of a recently published cohort study involving 6,188,704 women aged 12–20 years, in which younger adolescent age was used as an unbiased determinant of pelvic size and the CSR was found to increase as maternal age declined [13]. Furthermore, the CSR was higher when the analysis was restricted to macrosomic infants [13]. These results indicate that in primiparous women, the CSR increases as the maternal age declines, suggesting fetopelvic disproportion due to pelvic immaturity. Moreover, Seshadri reported that in low-risk pregnancies, age is the most important predictor of CS [14]. Therefore, a maternal age >22 years protects against CS. This finding does not apply to elder primiparous women (aged ≥ 35 years). However, in a retrospective analysis of 11,815 patients, Witter et al. [7] concluded that primary CSRs increase with an increase in maternal age. This result does not contradict our findings because the target group for that study included both primiparous and multiparous women who underwent CS for the first time. In the present study, the significant differences in gestational age and PIH between the group that delivered by CS and the control group disappeared upon logistic regression analysis, indicating that these were confounding variables.

**Conclusion:** The present study shows the CSR is increasing. Common indications for CS were fetal distress, breech presentation in labor, failed induction of labor, and failure to progress. This increase in the CSR was significantly associated with younger maternal age (≤22 years) and a fetal birth weight ≥4 kg. Healthcare providers should be particularly attentive to this particular population.

**Disclosure:** we declare no conflict of interest

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**Figure 1: indications of Cesarean delivery among the study group**

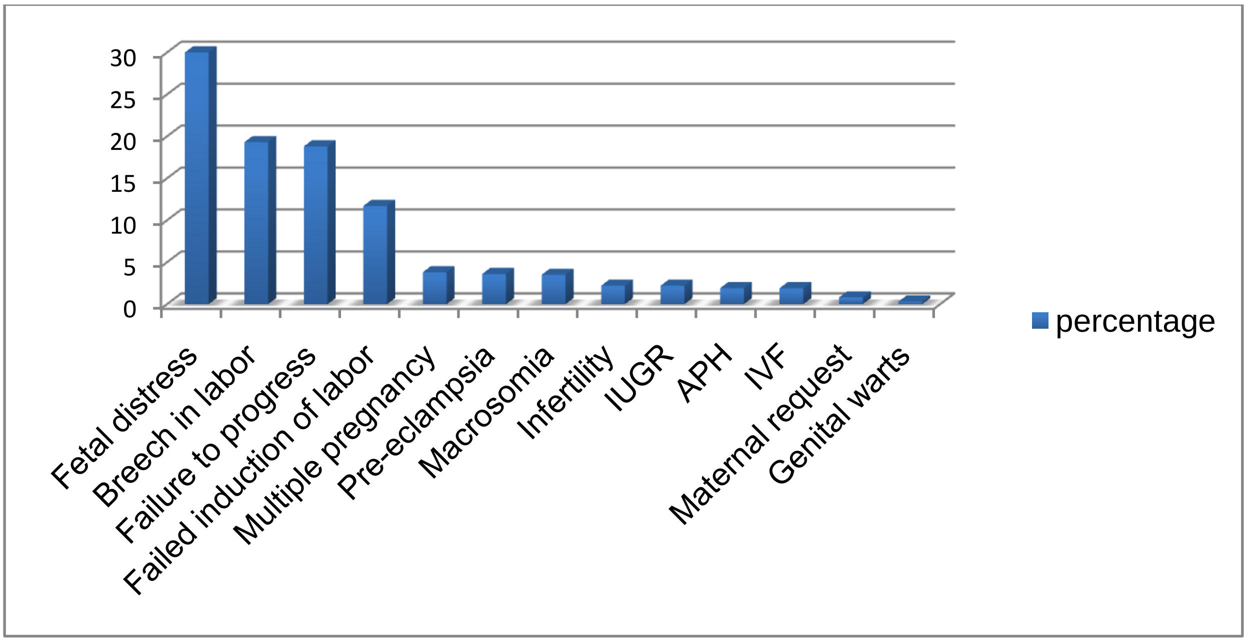
30
25
20
15
10
5
0
Fetal distress
Breech in labor
Failure to progress
Failed induction of labor
Multiple pregnancy
Pre-eclampsia
Macrosomia
Infertility
IUGR
APH
IVF
Maternal request
Genital warts
percentage

**Table 1: Maternal and perinatal outcome in primiparous' women and controls**

| Characteristics | Study group (n=354) | Control group (n=354) | p-value |
|---|---|---|---|
| PPH | 1(.3) | 6(1.5) | 0.1265 |
| DVT | 2(.5) | 2(1.0) | 1.0000 |
| Diabetes mellitus | 10(2.8) | 20(5) | 0.127 |
| Pregnancy induced hypertension | 23(6.5) | 10(2.5) | 0.007 |
| Prelabor preterm rupture membrane | 4(1.1) | 0% | .033 |
| Prelabor rupture membrane | 6(1.7) | 9(2.3) | .586 |
| Malformed babies | 1 (.3) | 0 | 1.0000 |
| NICU | 68 (19.3) | 6 (1.5) | <0.001 |
| Medical problem | 1(.3) | 10(2.5) | 0.011 |
| Instrumental delivery | 0 | 13(6.5) | 0.0003 |
| Bladder injuries | 1 (.3) | 2(1.0) | 1.0000 |
| Tear | 3(.8) | 11(2.8) | 0.0599 |
| fetal birth weight | 3.0450±.59156 | . 3.2745±.24072 | p<0.0001 |
| Apgar score | 7.7684±1.19845 | . 8.3200±.80263 | p<0.0001 |

Values are presented as mean ±SD and number (percentage), P value was set at p<0.05 statistically significant

Abbreviations: PPH, postpartum hemorrhage; DVT, deep vein thrombosis; NICU, neonatal intensive care unit

**Table 2: Univariate and multivariate analysis of cesarean section and some selected risk factors**

| Variable | Control group (n=354) | Study group (n=354) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Univariate | | | Multivariate | | |
| | | OR | 95% CI | P value | OR | 95% CI | P value |
| MA | 1.00* | .908 | .869-.950 | .000 | 1.868 | 1.383-2.523 | .000 |
| F BW | 1.00* | 3.480 | 2.393-5.060 | .000 | 3.491 | 2.082-5.854 | .000 |
| GA | 1.00* | 1.207 | 1.111-1.311 | .000 | .991 | .876-1.120 | .882 |
| DM | 1.00* | 1.811 | .836-3.922 | .132 | .507 | .215-1.195 | .120 |
| PIH | 1.00* | .369 | .173-.786 | .010 | 1.374 | .605-3.125 | .448 |

1* reference category

Abbreviations: OR, odds ratio; CI confident interval; FBW, fetal birth weight; GA, gestational age; DM, diabetes mellitus;PIH , pregnancy induced hypertension