Predictors of Cesarean Section in Term Nulliparous Women Presented in Labour at Tertiary Hospital: *A Cohort Study*

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Abstract

Objective: To identify predictors of cesarean section in a term nulliparous women presented in labour. So that we can avoid unnecessary primary cesarean section and in the same time avoid, as much as we can, obstructed labour.

Methods: This was a cohort study of 216 nulliparous patients presenting in labour at term with singleton vertex fetuses who were followed till delivery either vaginally (n = 144) or by cesarean section (n = 72). Multiple logistic regression was used to identify independent demographic and clinical predictors for cesarean delivery.

Results: Increased maternal weight, advanced gestational age, change in cervical dilatation & cervical effacement after two hours of admission and finally change in fetal head station after two hours of admission remained independently significant in a multiple logistic regression model for cesarean delivery.

Conclusions: The use of demographic and clinical criteria early during labour in nulliparous women with vertex presentation may reduce the potential morbidity associated with prolonged labour or second stage cesarean delivery.

Keywords: Nulliparous women; Cesarean section; Vertex presentation

Introduction

The rapid increase in cesarean birth rates in USA without clear evidence of concomitant decreases in maternal or neonatal morbidity or mortality raises significant concern that cesarean delivery is overused [1].

Approximately one-third of births in the United States are via cesarean section (CS). The rate of CS has increased dramatically since the 1990s, reaching a peak of 32.9% in 2009 [2]. The primary CS rate has increased from 14.5% in 1996 to 23.4% in 2007 and become a major driver in the total CS rate [1].

The CS rise is most prominent in women with previous sections and in nulliparous women with a term cephalic in spontaneous labour. The proportion of inductions of labour decreases in favor of elective CS, while the ongoing inductions of labour more often end in non-elective CS. As the rate of CS continues to rise in, it is important to analyze the reasons for this trend and to unravel the underlying motives to perform CS [3].

Management of early labour in the particular subgroup of nulliparous women at term, with singleton fetuses in vertex presentation, may have a significant impact on the total CS rate [2,3].

The aim of this study was to identify predictors that place a term nulliparous patient with vertex presentation in labour at risk for cesarean section.

Subjects and Methods

This was a prospective cohort study carried out at the labour ward at the Department of Obstetrics and Gynecology, Menoufia University Hospital, Menoufia, Egypt in the period between January 2015 and May 2015.

The ethical review board of Menoufia faculty of Medicine approved the study protocol and an informed written consent was obtained from all participants prior to commencing the study.

Based on the WHO recommendations about Cesarean section rate among nullipara not to exceed 15% from the literature, power was set at 0.8, alpha level at 0.05, and the confidence interval (CI) at 95%. A total sample size of 170 nulliparous women was needed for this trial. We enrolled 216 participants to compensate for possible drop out of cases.

The study was conducted on 216 healthy pregnant nulliparous women at 37 weeks and beyond, in labour with single fetus in vertex presentation, reactive non-stress test and normal umbilical arterial Doppler indices.

Labour was defined as the persistence of at least two symptomatic uterine contractions within a 10-minute period in the presence of cervical dilation between 1 and 3 cm and cervical effacement of at least 50%.

Women with 6 non-vertex presentation, preterm labour, multiple pregnancy, intrauterine fetal death, fetal macrosomia, fetal congenital malformations, polyhydramnios, severe anemia, severe hypertension, uncontrolled diabetes mellitus, coagulopathy and any contraindication for the vaginal delivery were excluded from the study.

A detailed history including age, parity, and period of gestation were noted and details of clinical examination were also recorded. Ultrasonography was done to confirm gestational age, presentation, estimated fetal weight, placental localization and umbilical arterial Doppler indices.

Eligible women accepting to participate in the study were examined regularly every 1-2 hours after admission to evaluate the degree of cervical dilatation and progress of labour. Vital signs were also monitored. Artificial rupture of membranes (AROM) was performed for women with intact membranes when their cervical dilatation reached 4 cm and intravenous oxytocin infusion was started if there are inadequate uterine contractions (< 200 MVU). A low dose oxytocin infusion was started at 2 milli international units per minute and increased in increments of 1 - 2 2 milli international units per minute at 15 - 30 minutes' intervals as needed to achieve adequate uterine contraction pattern (≥ 200 MVU). Analgesia was given on the patient's request and at the discretion of the obstetrician. Continuous electronic fetal monitoring, Cardiotocograophy (CTG), was used during delivery and the modified WHO partograph was used for follow up for the progress of labour.

Our patients were divided into two groups according to the mode of delivery, normal vaginal delivery group (n = 72) and cesarean section group (n = 144). The decision for cesarean section in our study population was based on clinical basis as failure to progress and abnormal fetal heart rate (FHR) tracing.

Statistical analysis

Data were collected, tabulated, statistically analyzed by computer using SPSS version 16(SPSS Inc, Chicago, IL, USA), two types of statistics were done:

Descriptive statistics:

Quantitative data are expressed to measure the central tendency of data and diversion around the mean, mean (x) and standard deviation (SD). Qualitative data was expressed in number and percentage with Chi-Square (X^2) test compares the counts of categorical responses between independent groups.

Analytic statistics:

Student t- test was used for comparison of two groups of normally distributed variables while Mann Whitney test was used for comparison of two groups of non-normally distributed variables.

All these tests were used as tests of significance as follows: P value > 0.05 was considered statistically non-significant. P value ≤ 0.05 was considered statistically significant and P value ≤ 0.001 was considered statistically highly significant.

A multiple logistic regression analysis was performed to identify independent risk factors for cesarean delivery. Factors were chosen for inclusion in the multiple regression analysis if they were significant by univariate analysis and would be easy to measure during the first two hours after admission. A multiple regression model for predicting risk was built and evaluated on our study population. The model was constructed by a stepwise selection from a univariate significant variable with P = 0.05 used as a criterion for both entries into and retention in the model.

Results

Out of 3214 pregnant women attending the emergency room, 311 primigravida with vertex presentation were enrolled, out of whom 95 were excluded (54 not meeting the inclusion criteria and 41 declined to participate).

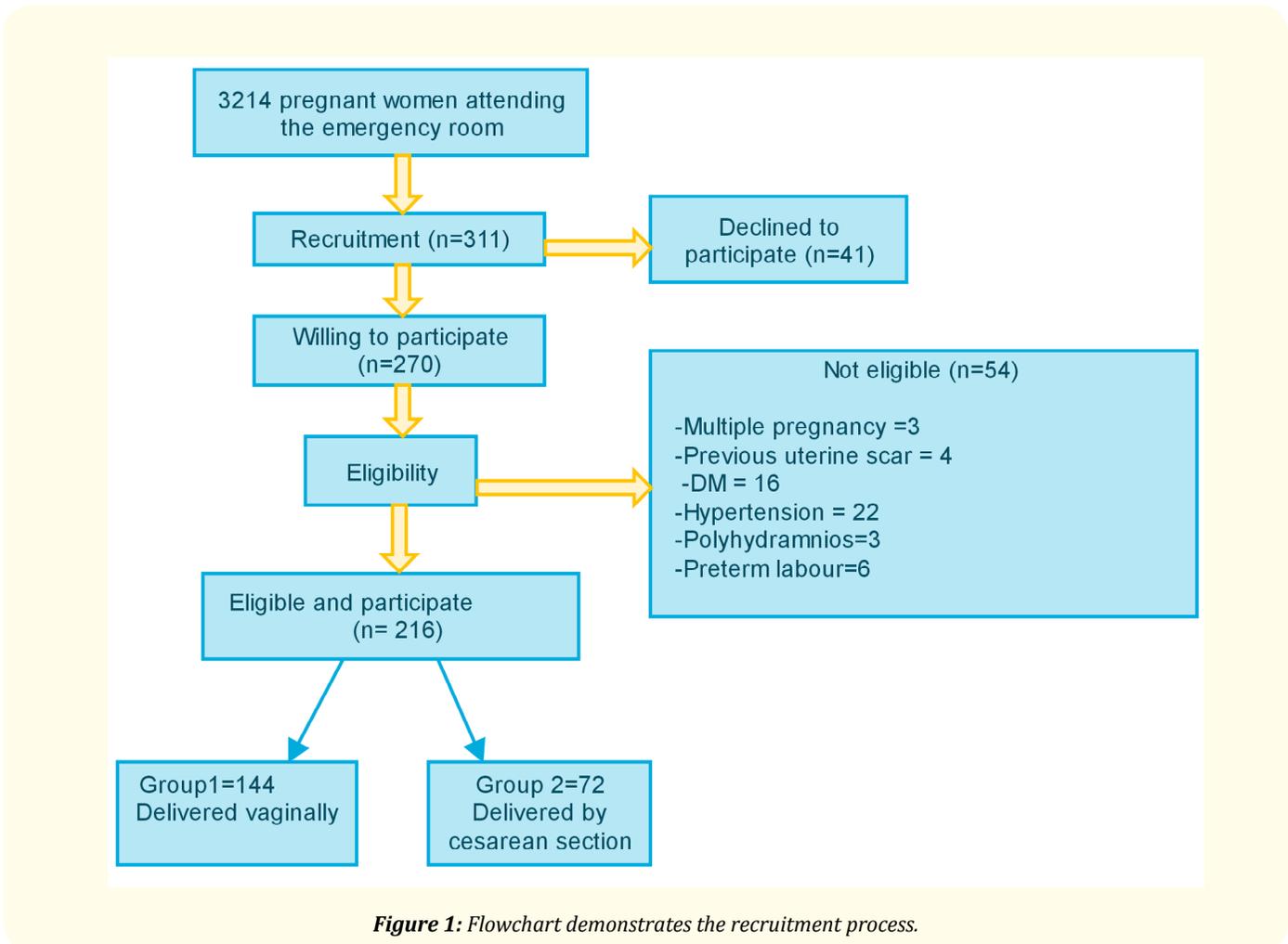Figure (1) reveals the flowchart diagram.

Figure 1: Flowchart demonstrates the recruitment process.

Table (1) reveals the maternal characteristics, there was a significant difference between the two groups regarding maternal age, weight, height and gestational age (p < 0.05).

	Vaginal delivery group (n=144)	Cesarean delivery group (n=72)	Student t-test	P-value
Age in years (Mean ± SD)	22.52 ± 4.11	23.78 ± 4.18	1.99	< 0.05
Duration of marriage in months (Mean ± SD)	14.64 ± 8.43	14.81 ± 6.99	U=0.14*	> 0.05
Weight in Kg (Mean ± SD)	73.07 ± 7.61	76.54 ± 8.32	2.88	< 0.05
Height in cm (Mean ± SD)	163.79 ± 5.0	161.87 ± 4.81	2.55	< 0.05
Gestational age in weeks (Mean ± SD)	38.75 ± 0.85	39.24 ± 1.30	2.84	< 0.05
Hemoglobin concentration in gm% (Mean ± SD)	10.87 ± 0.88	10.87 ± 0.99	0.04	> 0.05

Table 1: *Maternal characteristics*

*Mann Whitney test

Table (2) shows labour criteria at admission, more women in the cesarean delivery group presented with rupture of membranes (p < 0.05), meconium-stained amniotic fluid, non-engaged fetal head, lesser cervical dilatation & effacement and higher estimated fetal weight by ultrasound (p < 0.001).

	Vaginal delivery group (n=144)	Cesarean delivery group (n=72)	Chi-square	P-value
Meconium stained amniotic fluid (n/%)	21 (14.6%)	44(61.1%)	6.87	< 0.001
Rupture of membranes (n/%)	90 (62.5%)	34(47.2%)	2	< 0.05
Head station ≥ 0 station (n/%)	113 (78.4%)	8 (11.1%)	9.25	< 0.001
Cervical dilatation in cm (Mean ± SD)	5.51 ± 1.60	4.30 ± 1.23	5.42*	< 0.001
Cervical effacement in % (Mean ± SD)	77.96 ±11.34	63.06 ±14.08	7.84*	< 0.001
Estimated fetal weight by U/S in Kg (Mean ± SD)	3.04 ± 0.19	3.34 ± 0.46	5.27*	< 0.001

Table 2: *Labour criteria at admission.*

*Student t-test

Table (3) shows the changes in cervical parameters and fetal head station after two hours from admission, more women in the vaginal delivery group experienced better cervical dilatation & effacement and engagement of the fetal head after two hours from admission (p < 0.001). Figure (2) reveals the change in cervical dilatation after 2 hours and Figure (3) reveals the change in cervical effacement after 2 hours.

	Vaginal delivery group (n=144)	Cesarean delivery group (n=72)	Student t-test	P-value
Cervical dilatation after 2hours (Mean ± SD)	6.93± 1.53	5.06 ± 1.36	8.27	<0.001
Cervical effacement after 2 hours (Mean ± SD)	87.50± 10.56	66.94 ±13.83	11.23	< 0.001
Head station ≥ 0 station (n/%)	137 (95.1%)	42 (58.3%)	6.57	< 0.001

Table 3: *Changes in cervical dilatation & effacement and fetal head station after two hours.*

*Chi-square test

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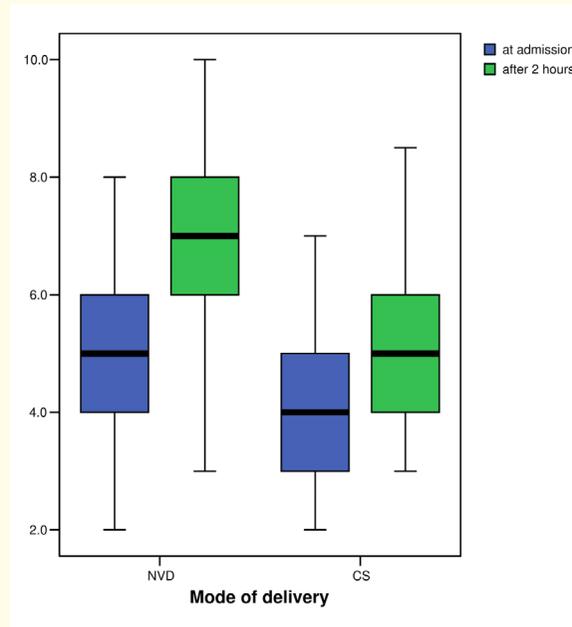
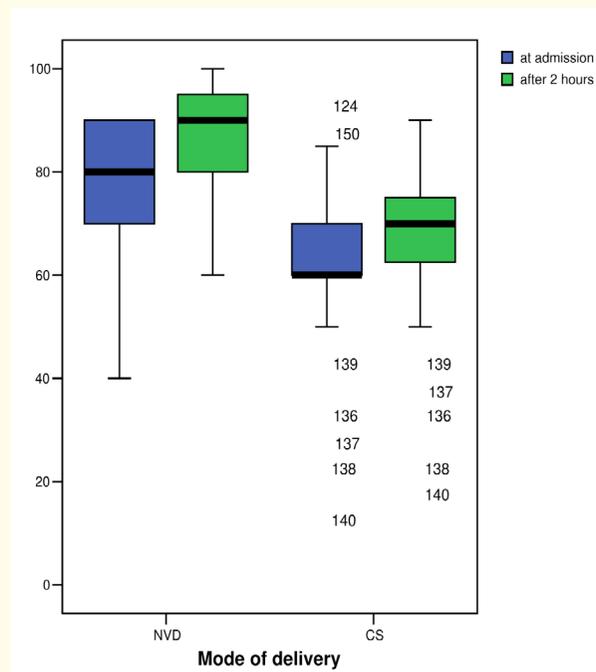*Figure 2: Change in cervical dilatation after 2 hours.*

Figure 3: Change in cervical effacement after 2 hours.

Table (4) reveals the labour dynamics, no difference between the two groups regarding the use of oxytocin and analgesia (p > 0.05). There was a highly significant difference between the two groups regarding the neonatal weight with bigger neonates in the cesarean delivery group (p < 0.001).

	Vaginal delivery group (n=144)	Cesarean delivery group (n=72)	Chi-square	P-value
Augmentation by Oxytocin (n/%)	124 (86.1%)	54 (75%)	3.56	> 0.05
Analgesia during labour -None - Epidural -IM Pethidine	124(86.1%) 4 (2.7%) 16 (11.1%)	62 (86.1%) 1 (1.3%) 9 (12.5%)	- 0.21 0.17 0.08	> 0.05
Neonatal weight in kg (Mean ± SD)	3.05 ± 0.19	3.38 ± 0.45	- 5.91*	< 0.001

***Table 4:** Labour dynamics.*

*Student t-test

Table (5) reveals the predictors of cesarean section by univariate and multivariate analysis, these predictors were maternal weight, gestational age, change in cervical dilatation & cervical effacement after two hours of admission and finally change in fetal head station after two hours of admission.

	β-coefficient	Wald test	P-value	Odd's ratio	95.0% C.I.	
					Upper	Lower
Maternal weight	-0.02	0.18	< 0.05	0.98	0.91	1.10
Gestational age	0.84	7.0	< 0.05	2.3	1.2	4.3
Change in cervical dilatation after 2 h	-0.57	6.8	< 0.05	0.6	0.37	0.87
Change in cervical effacement after 2 h	-0.14	19.1	< 0.001	0.87	0.82	0.93
Change in fetal head station after 2 h	1.5	26.5	< 0.001	4.6	2.6	8.3

***Table5:** Predictors of cesarean section by univariate and multivariate analysis.*

Discussion

Our study included 216 term nulliparous women with vertex presentation, out of which 144 (66.6%) parturient delivered vaginally and 72 (33.4%) delivered by emergency CS. This high CS rate observed in our study was in accordance with most parts of the world.

The overall CS rate in a term, nulliparous women in New Zealand from 2006 to 2009 was 31.2% (elective 7.8% and emergency 23.4%) [4].

Birth certificate and maternal in-patient hospital discharge records for 2004 - 2006 in Massachusetts, USA were linked. The study population was nulliparous, term, singleton, and vertex births (NTSV) (n = 80,371) in 49 hospitals. Overall, among women with NTSV births, 26.5% births were cesarean, with a range of 14% to 38.3% across hospitals [5].

In a population-based record linkage study of births in 81 hospitals in New South Wales, 2009 - 2010. The overall CS rate was 30.9%, ranging from 11.8% to 47.4% (interquartile range, 23.9% - 33.1%) among hospitals. Marked unexplained variation in hospital CS rates persisted for nulliparous women at term [6].

Retrospective cohort study of 28,863 nulliparous term singleton vertex births at 40 Arizona hospitals in USA. The average nulliparous term singleton vertex cesarean delivery rate was 22.0%, the lowest hospital rate was 10.3% and the highest was 34.2% [7].

Delivery in a tertiary or teaching hospital with an obstetrics and gynecology residency as in our hospital, was associated with an increased risk of cesarean delivery as found in previous studies [1,7].

The indications of cesarean section in our series were labour dystocia in 52/72 (72.2%) of patients and non-reassuring fetal heart rate (FHR) tracing in 20/72 (27.8%) which is consistent with previous studies [7,8].

In our study, multiple logistic regression showed that predictors of CS were increased maternal weight, gestational age, change in cervical dilatation & cervical effacement after two hours of admission and finally change in fetal head station after two hours of admission. Other demographic and clinical data was insignificant after univariate analysis including maternal age, hemoglobin concentration, meconium stained amniotic fluid, rupture of membranes, estimated fetal weight, use of oxytocin and obstetric analgesia.

In a previous prospective observational cohort study of 4341 consecutive nulliparous women with a single cephalic presentation, and spontaneous onset of labor between 37 and 42 weeks' gestation. The incidence of cesarean delivery rose significantly with an increase in body mass index (BMI). Women in labor with a BMI > 35 had a 3.8 times greater chance of a cesarean delivery than women with a BMI < 25 after adjustment for other variables [9].

In a recently published trial, overweight and obese BMI and above recommended gestational weight gain are significantly associated with caesarean birth in singleton term pregnancies in Canada [10].

In a retrospective cohort study in a teaching hospital conducted in the Netherlands among 858 women ≥ 37 weeks' gestation with a singleton fetus in cephalic position and spontaneous labour. Multiple logistic regression showed that epidural analgesia (OR 4.6; 95% CI 2.6 to 8.4), occiputo- posterior position (OR 7.4; 95% CI 4.3 to 12.8), and advanced maternal age (OR 1.91; 95% 1.31 to 2.76) were risk factors for CS [11].

In a previous case-control, chart review study of 325 nulliparous patients presenting in labor at term with singleton vertex fetuses with either cesarean (patients) or vaginal (controls) delivery. Multiple logistic regression was used to identify independent risk factors for cesarean delivery. In univariate analysis, 22 variables were significantly different between patients and controls. Of 11 that were known within 2 hours of admission, five (change in cervical dilatation, maternal weight, gestational age, fetal station at 2 hours, and preeclampsia) remained independently significant in a multiple logistic regression model for cesarean delivery [12].

In a previous study, data were obtained prospectively on 925 nulliparous women in spontaneous term labor with a single fetus in cephalic presentation, in order to develop predictive models of operative delivery (mid-forceps or a cesarean). Independent predictors of operative delivery were maternal age and height, pregnancy weight gain, smoking status, gestational age, and cervical dilatation at admission [13].

There have been several studies in the past to develop cesarean delivery risk scores, but it included both nulliparous and multiparous women at term whether in labour or not and failed to determine an increased risk early in the course of labor [14,15].

Inability to explore other demographic and clinical risk factors, to include women with medical disorders and the small number of our study population were the main limitations of our study.

Under the conditions of our study, increased maternal weight, advanced gestational age, change in cervical dilatation & cervical effacement after two hours of admission and finally change in fetal head station after two hours of admission were strong predictors of CS in nulliparous women presented in labour.

Future research should involve recruitment of a group of nulliparous women who meet our entry criteria, applying these predictors, and then following them prospectively to observe the outcome of their delivery to determine whether the relationship we have observed in this study persists or not.

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Disclosure

We certify that no actual or potential conflicts of interest in relation to this article exist.

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