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ORIGINAL ARTICLE

Study of the Risk Factors for Cesarean Delivery in Induced Labors at Term

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About the Author

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Abstract

Background Induction of labor has become one of the most common interventions in obstetrics. Induction is indicated when the benefits to either mother or fetus outweigh those of continuing the pregnancy. Maternal complication rates that are increased in association with labor induction include cesarean delivery, chorioamnionitis, abruptio placentae, and uterine atony. So identifying those pregnancies that can be induced with low risk of cesarean delivery is important. The aim of this study was to identify those factors which influence the risk of emergency cesarean delivery in induced labors at term.

Methods It is a case–control study conducted at Tertiary care center and affiliated hospitals. In this study, odds ratio with 95 % confidence interval is taken as a measure of relative risk. Patients were evaluated for risk factors for cesarean section using logistic regression. Cases include all women who were induced at term and delivered by emergency cesarean section. Controls include all women who were induced at term and delivered vaginally.

Results The risk factors for cesarean delivery are advanced maternal age at delivery (≥35 years), high early pregnancy body mass index (≥30 kg/m^2), nulliparity, low preinduction Bishops score (<5), gestational diabetes mellitus, and intrauterine growth restriction.

Conclusion Women with multiple risk factors for cesarean can be taken up for elective cesarean section rather than inducing them at term.

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Keywords Induction of labor · Cesarean delivery · Risk factors

Introduction

The history of labor induction dates back to the time of Hippocrates' original descriptions in which mammary stimulation and mechanical dilation of the cervical canal are used methods of induction [1]. *Induction* implies stimulation of contractions before the spontaneous onset of labor, with or without ruptured membranes. *Augmentation* refers to stimulation of spontaneous contractions that are considered inadequate. Induction is indicated when the benefits to either mother or fetus outweigh those of continuing the pregnancy. Common indications include gestational hypertension, premature rupture of membranes, non-reassuring fetal status, postterm pregnancy, intrauterine growth restriction, and various maternal medical conditions such as chronic hypertension and diabetes.

Induction of labor has been associated with a risk of emergency cesarean delivery. The decision to induce a delivery in less imminent situation is often difficult. If induction fails, an emergency cesarean delivery has to be performed, and maternal risks are greater in emergency cesarean delivery than those in elective cesarean deliveries. So, the *aim* of this study was to identify those pregnancies which are associated with greater risk of cesarean delivery when induced at term.

Materials and Methods

Study Design

This is a *case–control study* in which odds ratio (OR) with 95 % confidence interval (CI) is used as a measure of *relative risk*.

Place of Study

Tertiary care center and affiliated hospitals.

Duration of Study

From June 2010 to December 2011.

Statistical Analysis

All comparisons are estimated and expressed as OR with 95 % CI. Using *logistic regression* analysis, all comparisons were estimated and were expressed as OR with 95 % CI. The data were modeled through multiple logistic regressions, and adjustments were made for independent variables that had a significant influence on the risk of cesarean delivery in the univariate analysis. The data analysis was performed using *IBM® SPSS® Statistics version 18* software and *Hosmer and Lemeshow Test*.

Study Population

The *cohort* included all women with a live singleton fetus in the cephalic position and induced at term (≥37 weeks). Cases were women who delivered by emergency cesarean section and controls were women with a vaginal delivery among the cohort. A total of 277 women were studied, out of which 117 women delivered by emergency cesarean section and 160 women delivered vaginally.

Data Collection

Information of women induced was obtained from case records and antenatal cards.

Definition of Variables

Maternal age was defined as age in completed years at delivery and divided into two categories (Age ≥35 years and age <35 years). *Parity* is defined as the number of previous pregnancies crossed age of viability (≥28 weeks). Maternal *weight* was taken in kilograms (Kgs) and *height* in meter (M) in early pregnancy (10–14 weeks), and body mass index (BMI) was calculated using the formula: Weight in Kgs/Height in M square. BMI was categorized into two groups (BMI ≤30 and BMI >30). Preinduction *Bishops score* was calculated [2]. *Indications* such as postterm pregnancy, gestational diabetes mellitus (GDM), hypertensive disorders in pregnancy, intrauterine growth restriction (IUGR), and premature rupture of membranes (PROM) for induction were taken into account. *Epidural analgesia* if used was noted. *Emergency cesarean* is defined as a cesarean delivery after failed induction, failed progress of labor, fetal asphyxia, or due to other intrapartum maternal or fetal complication.

Method of Induction

All women enrolled were examined prior to induction and induced using Dinoprostone gel (0.5 mg) intracervically (doses may be repeated after 6 h, with a maximum of two doses in 24 h) and if required, labor was augmented using oxytocin (starting dose of 6 mU/min, with 6 mU/min increase every 40 min, but employs flexible dosing based on uterine response).

Exclusion Criteria

The exclusion criteria include previous cesarean section, uterine scar (myomectomy), multifetalgestation, malpresentation, and where vaginal delivery was otherwise contraindicated.

Results

Using logistic regression analysis, all comparisons are estimated and expressed as OR with 95 % CI. Factors associated with cesarean delivery are analyzed (Table 1). Multivariate logistic regression of factors for cesarean delivery (Table 2).

Our study had shown that maternal age ≥35 years, BMI ≥30 kg/m^2, nulliparity, preinduction Bishops score less than 5, gestational diabetes mellitus, and intrauterine growth restriction are significantly associated with cesarean delivery. The presence of epidural analgesia, gestational hypertension, postterm pregnancy, and premature rupture of membranes is *not* associated with significant increase in cesarean delivery if labor is induced at term.

Discussion

Though advanced maternal age is not significantly associated with cesarean delivery in a study by Cnattingius et al. [3], a systematic review by Bayrampour et al. [4] has shown that there is an independent *association between advanced maternal age and cesarean delivery*. Our study has shown significant association of advanced maternal age with cesarean delivery in induced labors.

Poobalan et al. [5] did a systematic review on the effect of BMI in nulliparous women on mode of delivery. They concluded that cesarean delivery risk is increased by 50 % in overweight women (BMI 25–30 kg/m^2), and is more than double for obese women (BMI 30–35 kg/m^2) compared with women with normal BMI (20–25 kg/m^2).

Study by Sheiner et al. [6] and Ehrenberg et al. [7] also showed significant association between obesity and cesarean delivery even after the exclusion of hypertensive disorders and diabetes mellitus. Our study also has shown significant association between high BMI (>30 kg/m^2) and cesarean delivery.

A study by Cnattingius et al. [3], which resembles closest to our study has shown that the risk of cesarean delivery was increased among *nulliparous*. Similar association is seen between nulliparity and cesarean delivery in study by Ehrenberg et al. [7]. Our study also showed significant association between *nulliparity* and cesarean delivery.

As far as role of preinduction Bishops score is concerned, our study has showed significant association between low preinduction Bishops score (<5) and cesarean delivery. Similar results were seen in study by Johnson et al. [8].

Study by Ehrenberg et al. [7] and Rosenberg et al. [9] has shown significant association between cesarean delivery and pregestational as well as gestational diabetes mellitus. Our study has concluded the same results.

In our study, *epidural analgesia* is not significantly associated with cesarean delivery. Similar results are seen in study by Cnattingius et al. [3]. A study by Cynthia et al. [10] has also concluded that *neuraxial analgesia* in early labor did not increase the rate of cesarean delivery, and in fact it provides better analgesia and resulted in a shorter duration of labor than systemic analgesia.

Though study by Zhang et al. [11] showed that more than half of women with preeclampsia and eclampsia had cesarean delivery, our study did not show a significant association between *hypertensive disorders of pregnancy* and cesarean delivery. A multicentre, open-label-randomized-controlled trial by Koopmans et al. [12] has recommended that induction of labor is associated with improved maternal outcome and should be advised for women with mild hypertensive disease beyond 37-weeks' gestation.

In our study, *postterm pregnancy* is not significantly associated with cesarean delivery. Similar results were seen in a study by Sanchez-Ramos et al. [13]. They recommended that labor induction at 41-weeks' gestation for otherwise an uncomplicated singleton pregnancy reduces cesarean delivery rates without compromising perinatal outcomes.

Our study has shown that IUGR and cesarean deliveries are significantly associated. However, K E Boers and associates [14] have shown that there is no increase in operative and instrumental delivery rates in induced labors in pregnancies complicated by IUGR.

In our study, pregnancies with PROM and induction of labor are not significantly associated with cesarean deliveries. Induction of labor in such cases reduces risk of maternal infections. Systematic review by Dare et al. [15] concluded the same results.

A vaginal delivery is the best choice for both mother and child. However, it is better to take those patients with multiple risk factors for elective cesarean section rather than inducing them at term. Our study does not have sufficient power to evaluate the combined effect of several risk factors for cesarean delivery when labor is induced at term and further evaluation is needed for this.

Table 1 Analysis of risk factors for cesarean delivery

Sr. no.	Risk factors	Cesarean delivery ($N = 117$) no (%)	Vaginal delivery ($N = 160$) no (%)	Crude odds ratio (95 % CI)
1.	Maternal age			
	<35 years	107 (91.46)	158 (98.75)	**7.383 (1.586–34.367)**
	≥35 years	10 (8.54)	2 (1.25)	
2.	Body mass index (Kg/M^2)			
	≤30	79 (67.52)	148 (92.5)	**5.93 (2.934–11.996)**
	>30	38 (32.48)	12 (7.5)	
3.	Parity			
	Nullipara (0)	105 (89.75)	98 (61.25)	**0.181 (0.092–0.355)**
	Multipara (≥1)	12 (10.25)	62 (38.75)	
4.	Bishops score			
	<5	78 (33.3)	73 (54.4)	**0.4195 (0.2559–0.6879)**
	≥5	39 (66.7)	87 (45.6)	
5.	Epidural analgesia			
	No	79 (32.5)	113 (29.4)	1.1565 (0.6908–1.9360)
	Yes	38 (67.5)	47 (70.6)	
6.	Hypertensive disorders in pregnancy			
	Yes	32 (27.4)	49 (30.6)	0.8528 (0.5032–1.4453)
	No	85 (72.6)	111 (69.4)	
7.	Gestational diabetes mellitus			
	Yes	27 (23.1)	21 (13.1)	**1.9857 (1.0587–3.7244)**
	No	90 (76.9)	139 (86.9)	
8.	Postterm pregnancy			
	Yes	36 (30.8)	48 (30)	1.0370 (0.6177–1.7411)
	No	81 (69.2)	112 (70)	
9.	IUGR			
	Yes	1 (0.9)	15 (9.4)	**0.0833 (0.0108–0.6402)**
	No	116 (99.1)	145 (90.6)	
10.	PROM			
	Yes	23 (19.7)	24 (15)	1.3865 (0.7389–2.6019)
	No	94 (80.3)	136 (85)	

IUGR intrauterine growth restriction, *PROM* premature rupture of membranes, *CI* confidence interval

Statistically significant data is marked in bold

Table 2 Multivariate analysis of risk factors for cesarean delivery

Sr no.	Risk factors	Adjusted odds ratio (95 % CI)	Sig.
1	Maternal age	8.683	**0.003**
2	Body mass index	28.505	**0.000**
3	Nulliparity	28.025	**0.000**
4	Bishops score	12.067	**0.001**
5	Epidural analgesia	0.306	0.580
6	Hypertensive disorders in pregnancy	0.350	0.554
7	Gestational diabetes mellitus	4.672	**0.031**
8	Postterm pregnancy	0.019	0.891
9	IUGR	9.014	**0.003**
10	PROM	1.041	0.308

IUGR intrauterine growth restriction, *PROM* premature rupture of membranes, *CI* confidence interval

Statistically significant data is marked in bold

Conflict of interest None.

Ethical Statement Study was approved by ethical committee of Armed Forces Medical College, Pune.

References

1. De Ribes C. De l'Accouchement Provoque, Dilatation du Canal Genital al'Aide de BallonsIntroduitsdans la Cavite Uterine Pendant la Grossesse. Paris, Steinheil, 1988.
2. Bishop EH. Pelvic scoring for elective induction. Obstet Gynecol. 1964;24(2):266–8.
3. Cnattingius R, Höglund B, Kieler H. Emergency cesarean delivery in induction of labor: an evaluation of risk factors. Acta Obstet Gynecol Scand. 2005;84:456–62. doi:10.1111/j.0001-6349.2005.00620.x.
4. Bayrampour H, Heaman M. Advanced maternal age and the risk of cesarean birth: a systematic review. Birth. 2010;37:219–26. doi:10.1111/j.1523-536X.2010.00409.x.
5. Poobalan AS, Aucott LS, Gurung T, et al. Obesity as an independent risk factor for elective and emergency caesarean delivery in nulliparous women—systematic review and meta-analysis of cohort studies. Obes Rev. 2009;10:28–35. doi:10.1111/j.1467-789X.2008.00537.x.
6. Sheiner E, Levy A, Menes TS, et al. Maternal obesity as an independent risk factor for caesarean delivery. Paediatr Perinat Epidemiol. 2004;18:196–201. doi:10.1111/j.1365-3016.2004.00557.x.
7. Ehrenberg HM, Durnwald CP, Catalano P, et al. The influence of obesity and diabetes on the risk of cesarean delivery. Am J Obstet Gynecol. 2004;191(3):969–74.
8. Johnson DP, Davis NR, Brown AJ. Risk of cesarean delivery after induction at term in nulliparous women with an unfavorable cervix. Am J Obstet Gynecol. 2003;188(6):1565–72.
9. Rosenberg TJ, Garbers S, Lipkind H, et al. Maternal obesity and diabetes as risk factors for adverse pregnancy outcomes: differences among 4 racial/ethnic groups. Am J Public Health. 2005;95(9):1545–51.
10. Wong CA, Scavone BM, Peaceman AM, et al. The risk of cesarean delivery with neuraxial analgesia given early versus late in labor. N Engl J Med. 2005;352:655–65. doi:10.1056/NEJMoa042573.
11. Zhang J, Meikle S, Trumble A. Severe maternal morbidity associated with hypertensive disorders in pregnancy in the United States. Hypertens Pregnancy. 2003;22(2):203–12.
12. Koopmans CM, et al. Induction of labour versus expectant monitoring for gestational hypertension or mild pre-eclampsia after 36 weeks' gestation (HYPITAT): a multicentre, open-label randomised controlled trial. Lancet. 2009;374(9694):979–88.
13. Sanchez-Ramos L, Olivier F, Delke I, et al. Labor induction versus expectant management for postterm pregnancies: a systematic review with meta-analysis. Obstet Gynecol. 2003 Jun;101(6):1312–8.
14. BMJ 2010; 341 doi:10.1136/bmj.c7087.
15. Dare MR, Middleton P, Crowther CA, et al. Planned early birth versus expectant management (waiting) for prelabour rupture of membranes at term (37 weeks or more). Cochrane Database Syst Rev 2006, Issue 1. Art. No.: CD005302. DOI: 10.1002/14651858.CD005302.pub2.