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Identification of Risk Factors for Cesarean Delivery Following Induction of Labour

Rijal P[1]

[1]Department of Obstetrics and Gynecology, BP Koirala Institue of Health Sciences, Dharan, Nepal.

ABSTRACT

Background: Induction of labor is one of the most common procedures in obstetrics. Induction has been found to both increase and decrease the risk of cesarean delivery. Various studies have found different factors in different studies. The purpose of this study is to increase our knowledge of factors that increase risk of cesarean delivery when labour is induced at term.

Methods: A prospective observational study was conducted from June 2006-July 2007 at an obstetric unit of Eastern Nepal. A total of 348 patients in a 1:1 ratio (vaginal delivered n1-174, cesarean delivered n2-174) were enrolled in the study after inclusion and exclusion criteria were met. Logistic regression analysis was done to assess the significant variables.

Results: Maternal age, height, parity, indication of induction, gestational period at induction, presence of meconium in amniotic fluid, hypertension were not significantly associated with increased risk of cesarean delivery. In an adjusted model only birth weight, prolonged latent and active phases of labour, Bishop's score ≤5 were significantly associated with increased risk of cesarean delivery.

Conclusions: Bishop's score ≤5 at induction, obesity, three doses of misoprostol required for successful induction, use of oxytocin, prolonged latent phase, prolonged active phase, birth weight of neonate >4kg was significantly associated with increased risk of cesarean in unadjusted model but in an adjusted model only birth weight, prolonged latent and active phases of labour, Bishop's score ≤5 were significantly associated with increased risk of cesarean delivery.

Keywords: Bishop's score; cesarean delivery; hypertensive disorders of pregancy; induction of labour; post dated pregnancy.

INTRODUCTION

Induction of labor is defined as the artificial initiation of uterine contractions prior to spontaneous onset of labour.[1] Rates of induction of labour vary between 10-30% worldwide.[2] Hypertensive disorders of pregnancy, post dated pregnancy, maternal medical complications, Rh-isoimmunization, premature membrane rupture are the commonly accepted indications of induction.[3]

Induction increases the risk of medical intervention, analgesia, episiotomy, vacuum extraction and possibility of cesarean delivery.[4] Various studies have been conducted to identify the risks of cesarean section following induction of labour.[4-6] Maternal age,[7] multiparity,[8] Bishop's score,[9] prolonged latent phase,[10] choice of induction agent, presence of meconium stained liquor, fetal size,[11] and Oxytocin use,[12] maternal obesity,[13] short stature,[14] presence of hypertension,[15] have been considered as influential factors that increase the probability of cesarean following induction.

Correspondence: Dr. Pappu Rijal, Department of Obstetrics and Gynecology, BP Koirala Institue of Health Sciences, Dharan, Nepal. Email: drrijal315@yahoo.com, Phone: 9852022315.

METHODS

A prospective observational study was conducted from July 2006-July 2007, at obstetric unit of BP Koirala Institute of Health Sciences, Dharan, Nepal, which is the largest obstetric referral unit in Eastern Nepal. Consent from the patients was obtained for recruitment to the study. Ethical clearance from the institute's review board was obtained for the study. Sample size was calculated using obesity OR-2.03 (Hellie Kieller et. al),[4] with the power of test 80% and level of significance 5% , a total of 348 patients (n1- 174 vaginal delivered, n2-174 cesarean delivered) in a 1:1 ratio were enrolled in the study until target sample was achieved. Inclusion criteria was any women having an indication of labour induction with age 18-35 years on the day of induction and gestational age 37-42 completed weeks of gestation. Exclusion criterias were age below 18 and above 35 years of age, multiple gestation, severe pre-eclampsia, previous uterine scar, membrane rupture more then 12 hours, clinical chorioamnionitis, antepartum hemorrhage, and other malpresentation as these factors are likely to increase the risk of cesarean delivery independently when present.

The patients after having an indication of induction and inclusion and exclusion criteria met were recruited to the study. Indication of induction was as per the standards practiced in the institute. Maternal age in years, height in metres, weight in Kilograms, BMI in kg/m^2, gestational age from 37-42 completed weeks, pre-induction Bishop's score were entered into the data sheet. Misoprostol repeated at four hours interval up to maximum three doses was used as the induction agent. All patients were monitored in labour room with tocography one hour after induction and intermittent auscultation of fetal heart rate every half hour.Oxytocin augmentation was done if contractions were inadequate one hour after amniotomy. Partographic documentation for all patients was done after entry into active phase of labour. Cesarean section was performed when indicated. Duration of latent phase, active phase was recorded. Neonatal assessment regarding five minutes Apgar score, birth weight and NICU admissions were analyzed.

Data analysis was done using SPSS: ver 12, chi-square test was used as statistical test of significance. A logistic regression model was used to estimate the significant variables. Univariate analysis followed by multivariate analysis was performed .Variables with probability of significance <0.2 determined by univariate analysis was included in multivariate analysis. Variables with p ≤0.05 was considered significant.

RESULTS

It was seen that indication of induction, maternal age, maternal height, parity status, presence of hypertension had no association with the increased risk of cesarean while Bishop's score less than or equal to five, need of three doses of misoprostol, prolonged latent phase duration, prolonged active phase of labour, oxytocin augmentation, presence of meconium in amniotic fluid, neonatal birth weight had increased risk of cesarean (Table 1).

Table 1. V compared among the two groups along with the corresponding P - value.

Variables	N1	N2	Chi-square	OR	95%CI	P- Value
Bishop's score						
≤ 5 *	165	173	χ2=6.589	1	O.13-0.816	0.034
>5	9	1	P=0.010	0.016		
Misopostol doses						
1*	83	71	χ2=11.82	1	0.675-1.648	
2	82	74	P = 0.003	1.01		
3	9	29		3.76	1.672-8.848	0.001
Prolonged latent phase						
Normal*	170	89	χ2=34.82	1	4.725-40.40	0.000
Prolonged	4	29	P= 0.007	13.8		
Prolonged active phase						
Normal*	110	7	χ^2=58.43	1	4.725-40.567	0.000
Prolonged	64	65	P=0.000	13.89		
Oxytocin use *	72	131	χ^2=41.15	1	6.89-36.882	0.000
Not required	102	43	P=0.000	15.95		
Liquor						
Clear *	Clear *	129	χ^2=45.23	1	1.668-5.473	0.000
Meconium stained	18	63	P=0.000	3.02		
Birth weight						
< 2.5 kg	10	8	χ^2=11.31	0.923		
2.5-4 kg*	150	130	P= 0.003	1	0.354-2.048	
> 4kg	14	36		2.964	1.532-5.738	0.003

A total of 238 (n1-165, n2-173) had Bishop's score less or equal to five which was significantly associated with increased risk of cesarean but in multivariate analysis, when other factors were adjusted, the association was not seen. Total 154 (n1-83, n2-7) responded with single dose of misoprostol, 156 (n1-82, n2-74) responded to two doses of misoprostol, 38 (n1-9, n2-29) required three doses of misoprostol. Requirement of three doses of misoprostol had thrice increased risk of cesarean as compared to single dose. A total of 33 (n1-4, n2-29) had prolonged latent phase which had the strongest association with increased risk of cesarean, 129 (n1-64, n2-65) had prolonged active phase of labour and the increased risk of cesarean was 13 times as compared with normal duration of active phase. Oxytocin augmentation had 13 times increased risk of cesarean. Total of 81 (n1-18, n2-63) had presence of meconium in amniotic fluid and the increased risk was three times, 50 (n1-14, n2-36) had neonatal birth weight more than four kg and risk of cesarean was 1.5 times higher.

The five minutes Apgar score less then seven was higher in neonates delivered by cesarean (Table 2). Neonatal admissions to NICU was higher in cesarean delivered group, though meconium aspiration was higher in vaginal delivered group (Table 3). The various indications of cesarean section and fetal distress were the major group which probably explains the higher neonatal admissions rate in this group (Table 4). In the multivariate analysis of significant factors derived by univariate analysis, it was seen that Bishop's score was not significantly associated with increased risk of cesarean, requirement of three doses of misoprostol had six times increased risk of cesarean, prolonged latent phase had 16 times increased risk of being delivered by cesarean, women with prolonged active phase of labour had nine times increased risk of being delivered by cesarean and neonatal weight more than four kilogram had four times necessity of cesarean as compared to neonatal weight less then four kg (Table 5). Maternal complication like atonic postpartum hemorrhage was more in cesarean delivery, there was one case of retained placenta in vaginal delivered group.

Table 2. Comparison of APGAR scores among the two groups.

5 minutes APGAR score	Vaginal delivery	Cesarean delivery
≥ 7	161 (92.5%)	151 (86.8%)
< 7	13 (7.5%)	23 (13.2%)

Table 3. Comparing the various indications of NICU admissions among the two groups.

Indication	Vaginal delivery	Cesarean
Not admitted	160 (92.0%)	163 (93.7%)
Asphyxia	2(1.1%)	2 (1.1%)
Cleft lip , cleft palate	1(0.6%)	.....
Delayed cry	4 (2.3%)	1(0.6%)
Meconium aspiration	4 (2.3%)	1(0.6%)
Respiratory distress	3 (1.7%)	7 (4.0%)

Table 4. Demonstrating the various indications of cesarean delivery.

Indication of cesarean	Number (%)
Failed induction	43 (24.7%)
Fetal distress	80 (46.0%)
Meconium stained liquor	27 (15.5%)
Dystocia	24 (13.8%)
Failed induction	43 (24.7%)
Fetal distress	80 (46.0%)

Table 5. Shows the multivariate analysis of significant factors derived by univariate analysis.

Variables	SE	OR	95% CI	P- value
Bishop's score > 5*	----	----	-------	--------
Bishop's score ≤ 5	18.550	0.001	0.006-8.6 E+12	0.721
1 dose misoprostol *	----	----	-------	0.008
2 dose misoprostol	0.407	1.000	0.451-2.219	1.000
3 dose misoprostol	0.608	6.027	1.832-19.839	0.003
Normal latent phase duration*	----	----	-------	--------
Prolonged latent phase duration	0.710	16.039	3.985-64.551	0.000
Normal active phase duration*	------	----	-------	--------
Prolonged active phase duration	0.459	9.627	3.914-23.684	0.000
Birth weight 2.5-4 kg*	------	----	-------	0.003
Birth weight < 2.5 kg	1.210	0.197	0.16-2.469	0.208
Birth weight > 4 kg	0.479	4.384	1.702-11.109	0.002

DISCUSSION

The result of the present study is in accordance with similar studies published. In the present study 60% were induced for post-dated pregnancy (41 weeks) i.e. protocol practiced at our institute, whereas in the study by H.Kieller,[4] it was 23% and 57.5% in the study by Eray Caliskan,[6] were induced for the same indications, 51 % were induced for other indications in study by H.Kieller et al.[4] Indication of induction did not influence the risk of cesarean in all three studies.Similarly age had no significant influence on the risk of cesarean delivery, which is similar to the study conducted by H. Kieller (p-0.654).[4]

In the present study and the study by H. Kieller,[4] parity was not significantly associated with increased risk of cesarean delivery (OR -0.833 & 0.533 respectively) but in the study by Heffner et al,[8] and Buenos B et al,[17] multiparity had 1.7 times the risk of cesarean delivery. In the present study, obese had increased risk of cesarean in an unadjusted model (OR 1.092) but after adjusting for other factors obesity was no longer found to be significant. Similarly, in study by Kaiser P et al,[19] (OR- 3.99) and Jaymiyah etal,[20] obese had almost four times the risk as compared to non-obese and in the study by Seyb St et al,[13] (OR -1.9) and Usha Kiran et al,[20] obese had almost twice the risk of cesarean as compared to non-obese. In the study by Shiewer et al,[18] and H. Kieller et al,[4] short stature was significantly associated with increased risk of cesarean delivery (OR -1.7 & 2.06) but in the present study, short height was not associated with increased risk of cesarean delivery (OR -0.828) .

In the study by Francis PJ et al,[14] Bishop's score of ≥5 had twice the risk of cesarean delivery and in the present study Bishop's score was significant in both adjusted and unadjusted model. Patients with score ≤5 had thrice the risk of cesarean delivery in the adjusted model as compared to patients with a score of >5.

Aaren B, James M,[15] performed meta analysis of 14 trials (n-7984) to compare induction at less than 41 or more than 41 weeks, where the cesarean delivery rate was similar in either group. In the present study 136 (39.1%) were induced at less than 41 weeks and 212 (60.9%) were induced more than 41 weeks gestational age, induction at less or more then 41 weeks did not influence the risk of cesarean delivery, which is a similar result with the meta analysis. In the study by Chelmow, Maghoma et al,[16] (OR-1.65, 2.36) prolonged latent phase was associated with increased risk of cesarean delivery. In the present study (OR- 13.365), patients with prolonged latent phases had 13 times the risk of cesarean delivery as compared to those who had normal latent phase. Birth weight of more then four kg significantly increased the risk of cesarean delivery (OR-2.84) in the present study. In the present study, prolonged latent phase had the strongest association with risk of cesarean delivery, followed by prolonged active phase of labour and birth weight, each independently increased the risk of cesarean delivery when present.

CONCLUSIONS

Maternal age, height, parity, indication of induction, gestational period at induction, presence of meconium in amniotic fluid, hypertension was not significantly associated with increased risk of cesarean delivery. Bishop's score ≤5 at induction, obesity ,three dose of misoprostol required for successful induction, use of oxytocin, prolonged latent phase, prolonged active phase, birth weight of neonate more than four kg was significantly associated with increased risk of cesarean in unadjusted model but in an adjusted model only birth weight, prolonged latent and active phases of labour, Bishop's score ≤5 were significantly associated with increased risk of cesarean delivery. Other factors such as maternal smoking status, previous cesarean delivery and the risk of cesarean delivery after induction could not be evaluated in the study.

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