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A CASE CONTROL STUDY TO IDENTIFY THE RISK FACTORS FOR CESAREAN DELIVERY IN NULLIPAROUS WOMEN WITH INDUCED LABOR AT TERM

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ABSTRACT

Introduction: Induction of labor (IOL) is the most common intervention in obstetrics. The objective of this study was to assess the risk factors in term pregnancies and their delivery outcome following IOL. The purpose of the study of risk factors is that it adds more prognostic information to the counselling and planning process of IOL. **Method:** We conducted this case control study to compare caesarean section (CS) rate among nulliparous women with and without risk factors who were induced with similar labor induction protocol (tablet misoprostol 25 mcg, per vaginally, 4 hours apart, maximum 5 doses). A total of 200 nulliparous women at term with singleton pregnancy, who fulfilled inclusion and exclusion criteria were recruited after taking informed consent. The study was conducted over a period of 1 year in labor ward of obstetrics department of Dr RPGMC Tanda H.P. **Result:** Our study results demonstrated that maternal age ≥ 35 years, BMI ≥ 25kg/m2, pre-induction bishop score < 5 and hypertensive disorders of pregnancy are significantly associated with CS in patients after IOL. Further logistic regression was performed, to ascertain the effect of variables that were found to be statistically significant on univariate analysis, and on binominal logistic regression also BMI, bishop score and hypertensive disorders of pregnancy were found to have a statistically significant association with CS with AOR of 2.57 (1.24-5.33), 0.19 (0.09-0.39) and 0.28 (0.12-0.68) respectively. **Conclusion:** The present study emphasizes that both medical and elective IOL is associated with an increased risk of CS predominantly related to unfavourable Bishop score, increases BMI and hypertensive disorders of pregnancy. Patient should be counselled about these risk factors before IOL.

KEYWORDS: Induction of labor, Bishop score, Caesarean section.

INTRODUCTION

Induction of labor (IOL) is the process of artificial initiation of labor before it's spontaneous onset. Approximately 20% to 30% of all pregnancies undergo IOL and rates continue to rise.[1] IOL in patient with unripe cervix at term remains a challenge for the obstetrician. IOL involves a combination of cervical ripening with prostaglandins, amniotomy and intravenous oxytocin.

There are studies which conclusively prove that certain risk factors increase the risk of caesarean section (CS) in women undergoing IOL.[2,3,4] These factors are; Maternal age, parity, body mass index (BMI), pre induction Bishop score, associated medical disorders such as diabetes, hypertensive disorders, various indications of induction as post term pregnancy, fetal growth restriction (FGR), Premature Rupture of Membranes (PROM) and oligohydramnios.

Higher labor induction rates have been associated with increased CS rates, it reflects that appropriate selection criteria for IOL are missing, particularly in women who don't have any indication for prompt delivery. CS rates after IOL vary significantly across hospitals, especially

when induction is not based on commonly accepted indications.

The decision to induce should not be taken lightly as the process of induction itself being associated with maternal complication such as chorioamnionitis, fetal distress, risk of uterine hyperstimulation, uterine scar rupture, CS and postpartum haemorrhage from uterine atony.[5,6]

IOL is associated with emergency CS. Maternal risks are greater in emergency CS than those in elective CS. Assessment of these factors prior to IOL is warranted to reduce adverse pregnancy outcome associated to emergency CS. Also, if there is scoring of the risk factors it will help obstetrician to decide whether women with higher score should be taken for elective caesarean rather than inducing them at term.

In this era of litigation, women and their caregivers should be informed about benefits and risks related to the procedure, including risk of CS, when IOL is considered. This case control study was conducted at Dr. R.P.G.M.C. Tanda with an aim to assess the risk factors which increase the probability of CS rate after IOL.

Study design: An observational case control study
Place of Study: Labour ward of department of obstetrics and gynaecology at Dr Rajendra Prasad Government Medical College Kangra at Tanda (H.P.)
Duration of study: 1 year study March 2023 to February 2024

Methodology: An observational case control study was conducted in the labour ward of department of obstetrics and gynaecology at Dr Rajendra Prasad Government Medical College Kangra at Tanda (H.P.). The study was conducted after approval from institutional ethical committee.

METHOD OF INDUCTION

All patients were Induced with standard protocol of induction (vaginal misoprostol 25ug, 4 hourly, maximum of five doses in 24 hours) in labour ward. As parity is confounding factor for IOL hence multiparous women were excluded. All Nulliparous women in the age group of 18-40 years, with singleton live pregnancy with vertex presentation at term (POG≥37-42weeks) were enrolled. Exclusion criteria were, scarred uterus (previous CS, myomectomy, metroplasty), malpresentation, multiple foetal gestation, uterine malformation and contracted pelvis.

From the cohort of women enrolled for induction, the control and cases were selected according to the outcome of the delivery.

1. Group A (cases): 100 nulliparous women who underwent emergency LSCS, after IOL
2. Group B (control): 100 nulliparous women who were delivered vaginally, after IOL.

Data collection: Information of women who were induced obtained from case records and antenatal card. At the time of enrolment, demographic data, pre induction Bishop score and indication of IOL of all the women were noted on the proforma. The mode of delivery and foetal outcome were also recorded.

The following risk factors were studied for both the groups (control and cases): Maternal age, BMI, bishop score, hypertensive disorders of pregnancy, gestational diabetes mellitus, post term pregnancy, fetal growth restriction, PROM, oligohydramnios and birth weight. The indication of IOL and indication of caesarean section were also recorded.

Definition of Variables

1. Maternal age defined as age in complete years and were divided into two groups (age ≥35 years and age ≤34.9 years).
2. Parity defined as the numbers of previous pregnancies crossed age of viability (≥28wks).
3. Maternal weight taken in kilograms and height in meters in early pregnancy (10-14 weeks) and body mass index (BMI) was calculated. BMI was categorised into two groups {BMI≤24.9 and BMI ≥25} as per Asian Indian guidelines.
4. Pre induction Bishop score was calculated and divided into two groups (≥5 and <5).
5. Birth weight was divided into two groups (≤3. 4 kg. And ≥3. 5kg).
6. Composite maternal morbidity (defined as ≥1 of following during labour, delivery, or in the 4 weeks postpartum): third/fourth-degree perineal laceration, blood transfusion, endometritis, wound sepsis (defined by the need for additional wound closure or the needed for antibiotics), venous thromboembolism, hysterectomy, intensive care unit admission, or maternal death.

Statistical analysis

Data was entered into an excel sheet and analysed using Epi info. Qualitative data was expressed as percentages and proportions. Quantitative data was expressed as mean and standard deviation. The difference between 2 groups with respect to continuous variables was compared using independent t-test. Categorical variables between the groups were compared using chi square test. P value <0.05 was considered significant. The odds ratio and adjusted odd ratio were also calculated. The statistical analysis would be performed using software SPSS v21. 0(IBM, USA).

RESULTS

The maternal characteristics in both the groups were different (Table 1). The mean age of women in group A was 27.09±4.34 years and in group B was 25.00±3.88 years. (p value =0.001) as shown in table 1. The mean BMI of women in group A was more i.e, 24.71±3.37 kg/m2 than the woman in group B i.e 22.91±2.17 kg/m2, which was statistically significant (p value= 0.002). The

mean POG of women at the time of IOL in group A was 272.12±6.98 days and in group B was 274.41± 7.85 days. There was no statistically significant difference among both the groups in terms of mean POG (p value =0.10).

The bishop score of women in group A was less favorable than that in Group B and the difference was statistically significant (p = 0.001) It was observed that most common indication of IOL in group B was postdate pregnancy i.e. 41 women (41%) In group A most of the women were induced for medical disorders.(Table 1) There was statistically significant difference between the groups in terms of indication of induction i.e. Postdate (p value 0.003), Hypertensive disorders of pregnancy (p value 0.004) and diabetes (p value 0.003).

Table 2 shows association between antepartum risk factors to Caesarean section following IOL.

Maternal age ≥35 years is associated with a higher likelihood of CS. An odds ratio 2.67 indicates that the odd of undergoing CS is 2.6 times higher in nulliparous women, who were induced at age ≥ 35 years compared to those, who were less than 35 years [p-value 0.001 and odds ratio 2.67 (95% CI: 0.807-8.807)]. (Table 2). However, AOR was insignificant for age. (Table 3)

An OR of 2.96 indicates that the odd of undergoing CS is 2.96 times higher in nulliparous women, who were induced with BMI ≥ 25 kg/m2 compared to those, who had BMI <25 kg/m2, with (95% CI of 1.564 to 5.612) as shown in table 2.

In present study, 81(61.4%) patients in group A and 51(38.6%) patients in group B had bishop score < 5. The CS rate for women with Bishop < 5 was 61.4% and for women with Bishop score ≥5 was 38.6%. An OR of 4.096 indicates that the odd of undergoing CS is 4.09 times higher in nulliparous women, who were induced with Bishop score < 5 compared to those, who had Bishop score ≥ 5, with (95% CI of 2.17 to 7.73. Multivariate logistic regression showed AOR of Bishop score was significantly associated with CS [0.19(CI: 0.09-0.39), p value=0.001].

Medical Disorders (Hypertension and Gestational Diabetes)

Medical disorders were more common in cases than control group. Hypertension was significantly more prevalent in cases 28 women (68.3%) than controls 13 women (31.7%) (p = 0.008). Similarly, diabetes mellitus is significantly more common in cases 20 women (65.5%) than in controls 10 women (34.5%) (p = 0.01). This study provides valuable insights into the association between hypertension, diabetes mellitus, and caesarean section rates, highlighting these conditions as significant risk factors for CS. When CS rate in patients with and without above disorders was compared, OR of 2.60 (95% CI of 1.26 to 5.39). And 2.25(95%, CI: 0.93-4.81) were observed for hypertensive disorders of pregnancy and diabetes respectively. Hypertensive disorders are more significantly associated with CS with an AOR of 0.28 [(0.12-0.68), p value of 0.005].

The presence of diabetes, post term, PROM, FGR and oligohydramnios were not associated with increase in CS rate. The results were also not significant with multivariate regression analysis. Medical disorders were most common indication for IOL in group A (cases) whereas post-date pregnancy was most common indication for IOL in group B. In our study majority of women had cs for acute fetal distress 72 patients (72%) followed by failed induction in 19 women (19%) and non-progress of labor in 9 women (9%). No women in both groups experienced composite maternal morbidity in our study.

As shown in table 3 Logistic regression was performed to ascertain the effect of variables that were found to be statistically significant on univariate analysis, it was found on binominal logistic regression that BMI, bishop score and hypertensive disorders of pregnancy had a statistically significant association with CS with AOR of 2.57 (1.24-5.33), 0.19 (0.09-0.39) and 0.28 (0.12-0.68) respectively.

The presence of diabetes, post term pregnancy, PROM, FGR and oligohydramnios are not associated with significant increase in CS if labor is induced at term.

DISCUSSION

In the study by Dunn L et al[7] reported that advanced maternal age is a significant risk factor for caesarean delivery due to increased complications such as reduced myometrial contractility and higher rates of pre-existing medical conditions. Similarly, Rajput N et al[8] found that pregnancy at advanced age (≥35 years) is a high-risk pregnancy in term of increased maternal and perinatal morbidity and mortality.

As age increases, medical disorders in pregnancy also increase and hence rate of IOL and CS increases. In clinical practice, age is often considered a risk factor for various pregnancy complications, including CS. However, decisions should be individualized, taking into account the overall health, pregnancy history and preference of the woman. They should also be counselled regarding the potential risk associated with advance maternal age but emphasize that individual risk may vary. When using BMI ≥ 25 kg/m^2 in multivariate analysis it shows obesity doubles the risk of CS after IOL [AOR 2.57(CI:1.24-5.33), p= 0.01)].

Weiss JL et al[9] and Carlhall S. Et al[10], found that obesity is strongly associated with caesarean section due to factors such as macrosomia, prolonged labor, and increased rates of labor induction failures. Our study specifically noted a higher incidence of caesarean sections in women with BMI over 25kg/m^2. High BMI is

a recognized risk factor for various pregnancy complications, including CS. These findings support a possible biological relationship between obesity and increased CS rate as studies shows the amplitude and frequency of contraction is significantly reduced in obese women compared with normal weight women. The decrease in contractility is likely secondary to hormonal differences. Implementation of preconception BMI optimization, lifestyle modifications and antenatal weight management programs can help to reduce the CS

This finding is supported by study of Laughon SK et al[11], which demonstrated that a lower Bishop score is predictive of labor induction failure and subsequent cesarean delivery.

In the study by Vrouenraets FP[12] they concluded that compared with spontaneous onset of labor, elective IOL in nulliparous women at term with a single fetus in cephalic presentation is associated with an increased risk of CS predominantly related to an unfavorable score at admission. The finding of the present study is consistent with above, multivariate logistic regression showed AOR of Bishop score was significantly associated with CS [0.19(CI: 0.09-0.39), p value=0.001].

This study indicates that women with lower Bishop scores may require closer monitoring and possibly alternative approaches to induction to reduce the risk of caesarean delivery. This could involve strategies such as cervical ripening agents or delaying induction until the cervix is more favourable. Starting induction without any medical reason and with poor Bishop score increases the risk of CS, especially in nulliparous women. Hence IOL should be delayed under strict fetal monitoring in case of elective induction.

Zhang et al[13] showed that more than half of women with preeclampsia and eclampsia had CS. Langer et al[14] highlighted that gestational diabetes increases the risk of cesarean delivery due to fetal macrosomia and other complications.

These findings emphasize the importance of comprehensive management strategies for women with these conditions during pregnancy to mitigate the risk of adverse outcomes, including caesarean section.

Composite maternal morbidity: There was no significant difference in the incidence of composite maternal morbidity among the both the groups.

CONCLUSION

In our study in a cohort of 200 women requiring IOL four independent risk factors for CS were identified i.e. Maternal age ≥ 35years, BMI≥ 25kg/m2, pre-induction Bishop score < 5 and hypertensive disorders of pregnancy. The present study emphasizes that both medical and elective IOL in nulliparous women at term with single fetus in cephalic presentation is associated with an increased risk of CS predominantly related to unfavourable Bishop score, increases BMI and hypertensive disorders of pregnancy. The combinations of several risk factors lead to considerably increased risk of CS and its complications. The knowledge of these risk factors is most utmost importance to reduce the ongoing rise of CS rate.

LIMITATIONS

1. The relatively small sample size may limit the generalizability of the findings.
2. The samples were exclusively collected from a single tertiary institute, limiting the women population. Replication of this study across multiple institutes in a broader geographical area is warranted.

Table 1: Maternal characteristics and indication of IOL.

Sr. No.	Characteristic	Group A (Cases: CS, N=100)	Group B (Controls: NVD, N=100)	P-value
1. *	Mean Age (years)	27.09 ± 4.34	25.00 ± 3.88	0.001
2. *	BMI (kg/m^2)	24.71 ± 3.37	22.91 ± 2.17	0.002
3. *	POG (days)	272 ± 6.98	274± 7.85	0.10
4. *	Bishop Score	3.78 ± 0.760	4.41 ± 0.095	0.001
	Indications of induction	Group A (Cases) N=100(%)	Group B (Controls) N=100(%)	P value
5.	Postdated	20(20%)	41(41%)	0.003
6.	Hypertensive disorders of pregnancy	28(28%)	13(13%)	0.004
	GHTN	27(27%)	13(13%)	
	Severe preeclampsia	1(1%)	0(0%)	
7.	Diabetes mellitus	20(20%)	10(10%)	0.003
	GDM	19(19%)	10(10%)	
	Overt DM	1(1%)	0(0%)	
8.	ICP *(Intrahepatic Cholestasis)*	11(11%)	12(12%)	0.824
9.	PROM	9(9%)	7(7%)	0.795
10.	FGR	7(7%)	8(8%)	0.788

11.	Decreased fetal movement	4(4%)	7(7%)	0.537
12.	Oligohydramnios	1(1%)	2(2%)	0.561

**Data expressed as mean ± standard deviation*

Table 2: Association of antepartum risk factors to c- section following IOL.

Sr. No.	Variable	Group A	Group B	X2	P Value	Odd Ratio (95% CI)
1.	Maternal age ≥35 Years (N=14)	10(71.4%)	4(28.6%)	10.37	0.163	2.67(0.807-8.803)
2.	BMI ≥25 kg/m² (N= 60)	41(68.3%)	19(31.7%)	8.86	0.001	2.96 (1.564-5.61)
3.	Bishop score <5 (N=132)	81(61.4%)	51(38.6%)	7.48	0.002	4.09(2.17-7.73)
4.	HTN (N=41)	28(68.3%)	13(31.7%)	6.9	0.008	2.60(95%, CI : 1.26-5.39)
5.	Diabetes (N=30)	20(65.5%)	10(34.5%)	3.9	0.07	2.25 (95%; CI : =0.93-4.81)
6.	FGR (N=18)	7(35.9%)	11(61.1%)	1.5	0.459	0.61 (95%; CI : 0.23-1.64)
7.	PROM (N=16)	9(56.3%)	7(43.8%)	0.27	0.602	1.31 (CI; 0.47-3.67)
8.	Oligohydramnios (N=6)	3(50%)	3(50%)	0	1.00	1.00(CI ; 0.19-5.07)

Table 3: Multiple regression model of risk factors for css.

Sr. No.	Risk factors	Adjusted Odds Ratio AOR (95% CI)	P value
1.	Age	1.02 (0.25-4.17)	0.974
2.	BMI	2.57 (1.24-5.33)	0.011
3.	Bishop score	0.19 (0.09-0.39)	0.001
4.	Hypertensive disorders of pregnancy	0.28 (0.12-0.68)	0.005
5.	Diabetes mellitus	0.40 (0.15-1.05)	0.064
6.	FGR	1.25 (0.41-3.79)	0.69
7.	Oligohydramnios	0.51 (0.08-3.21)	0.476
8.	PROM	0.35 (0.11-1.12)	0.077

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