Original Research Article

Maternal factors affecting outcome of induction of labour

Shravani Devarasetty*, S. Habeebullah

Department of Obstetrics and Gynecology, Mahatma Gandhi Medical College and Research Institute, Puducherry, India

*Correspondence:
Dr. Shravani Devarasetty,
E-mail: dshravani51190@gmail.com

ABSTRACT

Background: Induction of labour is a common procedure in modern obstetrics and accounts for 20% among all deliveries. This study aims to assess the factors associated with success/failure of induction of labour.

Methods: This is a cohort study involving 220 women who underwent induction of labour in the department of obstetrics and gynaecology, MGMCRI from December 2016 to May 2018. After obtaining informed consent, patients were recruited into the study. Maternal parameters like age, parity, gestational age, BMI, Bishop score, indication of induction, method of induction, mode of delivery, maternal complications and neonatal parameters like Apgar score, birth weight and NICU admission were analyzed. Association of all parameters with mode of delivery was done by chi square test or Fisher exact test.

Results: Out of 220 women who were induced, vaginal delivery rate was 56.4%. Vaginal delivery rate was high in young women of age 20-25 years (65.2%), multiparous women (65.1%), gestational age of > 40-42 weeks (64.7%), with normal BMI (67.7%), with Bishop score ≥ 5(94.6%), induced for PROM and postdates (68.6%) and induced with single agent (74%). Most common indication of caesarean section was fetal distress (43.7%) followed by meconium stained liquor (30.2%). There were no adverse perinatal outcomes.

Conclusions: Women of age 20-25 years, normal BMI and induced with single agent showed statistically significant successful induction of labour.

Keywords: Bishop score, Caesarean section, Induction of labour, Vaginal delivery

INTRODUCTION

Induction is a common procedure in modern obstetrics and accounts for 20% among all deliveries.[1] In the United States, the rate of labour induction increased gradually from 9.5% to 19.4%.[2]

Reasons for these differences relate to the widespread availability of cervical ripening agents, pressure from patients, convenience for physicians, logistic factors, psychosocial reasons, and fear of litigation.[3] The goal of induction of labour is to pre-empt the natural process of labour by initiating its onset artificially by stimulating cervical ripening and uterine contractions before this

occurs spontaneously. Induction of labour has merit as a therapeutic option when benefits of expeditious delivery outweigh the risk of continuing the pregnancy. The indications of induction have increased over the years leading to increase in rate of induction of labour. The indication of induction with unfavourable cervix can be medical or elective. Medical induction is when there is some maternal or fetal indication whereas elective induction is for the convenience of the individual without any medical indication.[4]

The favourability of the cervix has a substantial impact on the potential success of any labour induction. Factors that contribute towards increasing the risks of a caesarean

section following labour induction include unfavourable cervix, nulliparity, obesity, mother's age above 30 years, fetal macrosomia, use of epidural analgesia, use of magnesium sulphate and chorioamnionitis.[5]

Most common methods for labour induction especially with an unfavourable cervix include intra vaginal insertion of Dinoprostone (PGE2), prostaglandin E1 (PGE1) analogue Misoprostol or intra-cervical insertion of Foley catheter. Regardless of cervical status and parity, vaginal delivery can be anticipated in the majority of patients undergoing labour induction. To avoid potential risks associated with the procedure, the woman and her fetus need to be monitored closely. This can strain the limited health-care resources in under-resourced settings.

This study was undertaken to identify the factors that affect the success and failure of induction of labour and thus to help improve quality of induction of labour and decrease unnecessary indications of the procedure.

METHODS

This was a prospective cohort study, which was conducted in the department of obstetrics and gynaecology, Mahatma Gandhi Medical College and Research Institute Hospital, a tertiary care hospital. The Institutional Human Ethics Committee approved this study. The study involved antenatal mothers and neonates. Study period was from December 2016 to May 2018. The pregnant women who were fulfilling the inclusion and exclusion criteria and willing to participate in the study were recruited. Written and informed consent was obtained from all patients who participated in the study. All related data were collected and entered into the proforma sheet. The study included women with singleton pregnancy with gestational age of 37-42 weeks with vertex presentation and adequate pelvis and excluded women with fetal anomalies, rupture of membranes for > 12 hours, chorioamnionitis, uterine scar and antepartum haemorrhage.

Statistical analysis

Continuous variables like age and BMI were expressed as mean and standard deviation. Individual parameters like age, parity, gestational age, BMI, Bishop score, indication of induction and method of induction were shown as percentages. Association of all parameters with mode of delivery was analysed using Chi-square test.

RESULTS

During the study period there were a total of 2,643 deliveries. Of them 773 women were induced giving the rate of induction of labour as 29.2%. On analysing the success of induction, the vaginal delivery rate was 56.4% and caesarean section rate was 43.6% and further analysis of various parameters with mode of delivery was as follows:

Table 1: Age and mode of delivery.

| Age (years) | Mode of delivery | | p value# |
	Vaginal delivery N (%)	Caesarean section N (%)	
20-25	86 (65.2)	46 (34.8)	
26-30	35 (50.7)	34 (49.3)	0.001*
31-35	3 (15.8)	16 (84.2)	

Note: # p value based on Chi-square test, * statistically significant (p<0.05).

Vaginal delivery rate was 65.2% in 20-25 years age group versus 15.8% in 31-35 years age group (Table 1).

Table 2: Parity and mode of delivery.

| Parity | Mode of delivery | | p value# |
	Vaginal delivery N (%)	Caesarean section N (%)	
Primi	70 (51.1)	67 (48.9)	0.04*
Multi	54 (65.1)	29 (34.9)	

Note: # p value based on Chi-square test, * statistically significant (p<0.05).

Vaginal delivery rate was 65.1% in multiparous women versus 51.1% in primigravidae (Table 2).

Table 3: Gestational age and mode of delivery.

| Gestational age | Mode of delivery | | p value# |
	Vaginal delivery N (%)	Caesarean section N (%)	
37-40 weeks	91 (53.8)	78 (46.2)	0.17
>40-42 weeks	33 (64.7)	18 (35.3)	

Note: # p value based on Chi-square test.

Vaginal delivery rate was 53.8% in 37-40 weeks versus 64.7% in > 40-42 weeks (Table 3).

Table 4: BMI and mode of delivery.

| BMI | Mode of delivery | | p value# |
	Vaginal delivery N (%)	Caesarean section N (%)	
Normal	67 (67.7)	32 (32.3)	
Overweight	45 (60.8)	29 (39.2)	0.001*
Obese	12 (25.5)	35 (74.5)	

Note: # p value based on Chi-square test, * statistically significant (p<0.05).

Vaginal delivery rate was 67.7% in normal BMI women versus 25.5% in obese women (Table 4).

Vaginal delivery rate was high in PROM and postdates women (68.6%) (Table 5). Bishop score <5 was associated with significantly high caesarean section rate

and score ≥ 5 was associated with high vaginal delivery in 94.6% (Table 6).

Table 5: Indication of induction and mode of delivery.

Indication of induction	Mode of delivery		p value#
	Vaginal delivery N (%)	Caesarean section N (%)	
Oligohydramnios	46 (58.2)	33 (41.8)	
PROM	35 (68.6)	16 (31.4)	
Post dates	24 (68.6)	11 (31.4)	
GHTN	8 (38.1)	13 (61.9)	
GDM on insulin	5 (25)	15 (75)	0.008*
GDM	4 (57.1)	3 (42.9)	
Prolonged latent phase	1 (20)	4 (80)	
Non-reactive NST	1 (50)	1 (50)	

Note: # p value based on Chi-square test, * statistically significant (p<0.05).

Table 6: Bishop score and mode of delivery.

Mode of delivery	Bishop score		p value#
	<5 N (%)	≥ 5 N (%)	
Vaginal delivery	89 (48.6)	35 (94.6)	<0.001*
Caesarean section	94 (51.4)	2 (5.4)	

Note: # p value based on Chi-square test, * statistically significant (p=<0.05).

Table 7: Method of induction and mode of delivery.

Mode of delivery	Method of induction		p value#
	Single agent N (%)	Multiple agents N (%)	
Vaginal delivery	71 (74)	53 (42.7)	<0.001*
Caesarean section	25 (26)	71 (57.3)	

Note: # p value based on Chi-square test, * statistically significant (p<0.05).

Vaginal delivery rate was 74% in single agent group versus 42.7% in multiple agent group and is statistically significant (Table 7).

Table 8: Indication for caesarean section.

Indication for caesarean section	N (96)	%
Fetal distress	42	43.7
Cephalo pelvic disproportion	12	12.5
Meconium stained liquor	29	30.2
Failed Induction	13	13.5

Majority of caesarean sections was due to fetal distress (43.7%) and followed by thick meconium stained liquor (30.2%) (Table 8).

Table 9: Maternal complications.

Maternal complication	N (220)	%
Nil	212	96.4
Postpartum haemorrhage	6	2.7
3rd degree perineal tear	2	0.9

Majority of women had no complications. Post-partum haemorrhage was seen in 2.7% cases and 3rd degree perineal tear in 0.9% cases (Table 9).

Table 10: Mode of delivery and 5 min APGAR score.

APGAR score At 5 min	Mode of delivery		p value#
	Vaginal delivery N (%)	Caesarean section N (%)	
≥ 7	123 (99.2)	91 (94.8)	0.06
< 7	1 (0.8)	5 (5.2)	

Note: # p value based on Chi-square test.

Apgar score at 5 min in new born was ≥ 7 in 99.2% vaginal delivery and 94.8% caesarean section group (Table 10).

Table 11: Mode of delivery and birth weight.

Birth weight	Mode of delivery		p value#
	Vaginal delivery N (%)	Caesarean section N (%)	
< 2.5 kg	18 (75)	6 (25)	
≥ 2.5 kg to 3 kg	73 (65.2)	39 (34.8)	0.001*
>3 to 3.5 kg	24 (37.5)	40 (62.5)	
>3.5 kg	9 (45)	11 (55)	

Note: # p value based on Chi-square test, * statistically significant (p<0.05).

Vaginal delivery rate was 75% in birth weight < 2.5 kg versus 45% in birth weight > 3.5 kg and it was statistically significant (Table 11).

Table 12: NICU admission.

NICU admission	N (220)	%
No	212	96.4
Yes	8	3.6

NICU admission for > 24 hours was required for only 3.6% new-borns (Table 12).

DISCUSSION

Rate of induction in our institution was 29.2% during the study period. Similarly, high rates of induction were observed in developed countries is between 20-30%.[6-8] The WHO quoted a figure of 12% for Asia.[9] Ours being a tertiary care hospital, a number of high-risk pregnancies are referred which may need induction of labour.

The definition we followed for successful induction was achieving vaginal delivery. In the present study 56.4% delivered vaginally. A study from Pakistan showed 18% failure rate of induction.[10]

Women who underwent induction of labour were in the age group of 20-25 years in the study. Mean age of these women was 25.1 years. The vaginal delivery rate in this age group was 65.2% compared to 15.8% in women above 30 years of age. A previous study showed that the mean age of induction was 22.3 years and vaginal delivery rate was 51.32%.[11] However, there are not many studies which analysed age and induction of labour.

Primigravidae constituted 62.3% and 37.7% were multiparous in the study. The vaginal delivery rate in nulliparous women was 51.1% versus 65.1% in multiparous women. Khan et al, from Pakistan did a study in which 61% of women were nulliparous and vaginal delivery rate was 74.7% in nulliparous women versus 93.2% in multiparous women. Failed induction was 4.6 times more likely in nulliparous women.[10]

In the study 76.8% of women were in gestational age of 37-40 weeks and 23.2% were in > 40-42 weeks. Generally, induction of labour in older gestational age is associated with increased risk of caesarean section. But in our study the vaginal delivery rate in early gestational age (37 to 40 weeks) was 53.8% versus 64.7% in late gestational age (> 40-42 weeks). This observation was supported by ACOG guideline which says that elective induction before 39 weeks of gestation usually results in higher Caesarean section rates[12] though Khan et al had contrary results which was probably due to elective induction at 40 weeks.[10]

Body mass index of the women who underwent induction of labour was recorded. Majority of the women were in normal BMI group (45%) and women in obese group were 21.4%. Mean BMI of women in the study was 25.6 kg/m^2. The outcome of induction of labour is also associated with body mass index of the women. Caesarean section rate was 32.3% in women with normal BMI versus 74.5% in obese women. A study in 2015 showed mean BMI as 26.5 kg/m^2 and it was concluded that caesarean section rates were higher in women with higher BMI.[13]

There are many indications for induction of labour. The most common indications being oligohydramnios, pre labour rupture of membranes and post-dated pregnancy which account to 75% of cases, followed by gestational hypertension (9.5%) and gestational diabetes (9.1%). Vaginal delivery rates were higher in oligohydramnios (58.2%), PROM (68.6%) and post-dated (68.6%) women. But Caesarean section rates were higher in gestational hypertension (61.9%) and GDM (75%) women. A systematic review done in 2009 showed post-dated pregnancy, PROM and oligohydramnios as most common indications for induction which supports the

present study.[14] Induction of labour in post-dated pregnancy associated with successful outcome of induction was supported by another study.[15]

In the present study, favorability of cervix was assessed based on pre-induction Bishop score. They were divided into Bishop score < 5 (83.2%) and Bishop score ≥ 5 (16.8%). Majority of women were with Bishop score < 5. Favorability of cervix is the main predictor for successful induction of labour. Vaginal delivery rate in Bishop score < 5 was 48.6% versus 94.6% in Bishop score ≥ 5. In another study failure rate was 84% in women with Bishop score < 5 versus 18% with Bishop score ≥ 5.[10]

Methods of induction of labour were divided into single agent group and multiple agent group. In single agent group usually either oral misoprostol or vaginal PGE2 gel was used whereas in multiple agent group mostly Foley catheter followed by PGE2 gel were used for cervical ripening. Women in single agent group were 43.6% and women in multiple agent group were 56.4%. In our study vaginal delivery rate in single agent group was 74% versus 42.7% in multiple agent group. Similar results were obtained in a study which showed 76.7% vaginal delivery in misoprostol group versus 56.8% in Foley catheter group.[16] And another study showed 70% vaginal delivery in PGE2 group versus 56% in Foley catheter group.[17] We have not analysed specifically any method of induction.

Mode of delivery in the study was vaginal in 56.4% and caesarean section in 43.6%. This was not statistically significant. There are many factors that led to this outcome like maternal age, parity, gestational age at which the women were induced, BMI, Bishop score, indication of induction and method of induction which were explained earlier. A recent study in 2016 showed that 63.5% had vaginal delivery and 36.5% had caesarean section following induction of labour.[18]

The most common indication for caesarean section in the study was fetal distress (43.7%) followed by thick meconium stained liquor (30.2%). Another recent study also showed fetal distress in 22.69% and meconium stained liquor in 19.33% as indications for caesarean section.[19]

There were no significant maternal complications. Post-partum haemorrhage was seen in 2.7% cases and 3rd degree perineal tear was in 0.9% of women. Very few studies have recorded maternal complications. Cervical tear and PPH were observed 4% each in a study from Bangladesh.[20]

Apgar score at 5 minutes was ≥ 7 in most of the babies. Only 2.7% babies had Apgar score < 7 at 5 minutes. 89.1% new borns had birth weight ≥ 2.5 kg. Vaginal delivery rate was 75% in birth weight < 2.5 kg versus 45% in birth weight > 3.5 kg. Higher birth weight babies are usually associated with increased risk of failed

induction.[21] Other studies concluded that induction of labour was associated with increased caesarean section risk and adverse perinatal outcomes.[22,23] Birth asphyxia was seen in 16% following induced delivery whereas in our study only 8 babies (3.6%) were admitted in NICU for more than 24 hours.[20]

The limitations of the study are no single protocol of inducing agents was used and cervical assessment was done by different personnel; so, the chances of bias persist.

CONCLUSION

We conclude that success of induction of labour that is achieving vaginal delivery was 56.4% in the study. Age < 30 years, lower BMI and single inducing agent were significantly associated with successful induction of labour. Nulliparity, indication for induction, gestational age ≤ 40 weeks, pre-induction Bishop score < 5 and increased birth weight (> 3 kg) were associated with increased caesarean section rate. There were no significant maternal or perinatal complications associated with induction of labour.

REFERENCES

1. Inducing labour, Guidance and guidelines, NICE. 2008: Available at: URI:https://www.nice.org.uk/guidance/qs60.
2. Zhang J, Yancey MK, Henderson CE. U.S. national trends in labor induction, 1989-1998. J Reprod Med. 2002;47(2):120-4.
3. Rayburn WF, Zhang J. Rising rates of labor induction: present concerns and future strategies. Obstet Gynecol. 2002;100(1):164-7.
4. Järvelin MR, Hartikainen-Sorri AL, Rantakallio P. Labour induction policy in hospitals of different levels of specialisation. Br J Obstet Gynaecol. 1993;100(4):310-5.
5. Vrouenraets FPJM, Roumen FJME, Dehing CJG, van den Akker ESA, Aarts MJB, Scheve EJT. Bishop score and risk of cesarean delivery after induction of labor in nulliparous women. Obstet Gynecol. 2005;105(4):690-7.
6. Zeitlin J, Mohangoo AD, Delnord M, Cuttini M, EURO-PERISTAT scientific committee. The second European perinatal health report: documenting changes over 6 years in the health of mothers and babies in Europe. J Epidemiol Comm Health. 2013;67(12):983-5.
7. WHO Recommendations for Induction of Labour. Geneva: World Health Organization; 2011.
8. Martin JA, Hamilton BE, Ventura SJ, Osterman MJK, Mathews TJ. Births: final data for 2011. Natl Vital Stat Rep Cent Dis Control Prev Natl Cent Health Stat Natl Vital Stat Syst. 2013;62(1):1-69.
9. Vogel JP, Souza JP, Gülmezoglu AM. Patterns and outcomes of induction of labour in Africa and Asia: a secondary analysis of the WHO global survey on maternal and neonatal health. PlosOne. 2013;8(6):e65612.
10. Khan NB, Ahmed I, Malik A, Sheikh L. Factors associated with failed induction of labour in a secondary care hospital. JPMA J Pak Med Assoc. 2012;62(1):6-10.
11. Marroquin GA, Tudorica N, Salafia CM, Hecht R, Mikhail M. Induction of labor at 41 weeks of pregnancy among primiparas with an unfavorable Bishop score. Arch Gynecol Obstet. 2013;288(5):989-93.
12. ACOG Committee on Practice Bulletins - Obstetrics. ACOG Practice Bulletin No. 107: Induction of labor. Obstet Gynecol. 2009;114(2 Pt 1):386-97.
13. Lee HR, Kim MN, You JY, Choi SJ, Oh SY, Roh CR, et al. Risk of cesarean section after induced versus spontaneous labor at term gestation. Obstet Gynecol Sci. 2015;58(5):346-52.
14. Mozurkewich E, Chilimigras J, Koepke E, Keeton K, King VJ. Indications for induction of labour: A best-evidence review. MCN Am J Matern Nurs. 2009;34:6.
15. Mishanina E, Rogozinska E, Thatthi T, Uddin-Khan R, Khan KS, Meads C. Use of labour induction and risk of cesarean delivery: a systematic review and meta-analysis. CMAJ Can Med Assoc J Assoc Medicale Can. 2014;186(9):665-73.
16. Noor N, Ansari M, Ali SM, Parveen S. Foley Catheter versus vaginal misoprostol for labour induction. Int J Repro Med. 2015. Available at: https://www.hindawi.com/journals/ijrmed/2015/845735/.
17. Dahlia Mary A. Induction of Labour - Foley's Catheter versus Prostaglandin E2 Gel. Madras Medical College, Chennai; 2010. Available at: http://repository-tnmgrmu.ac.in/4094/.
18. Bello. Predictors of successful induction of labour at a tertiary obstetric service in Southwest Nigeria. Available at: http://www.tjogonline.com/article.asp?issn=0189-5117;year=2016;volume=33;issue=2;spage=143;epage=148;aulast=Bello.
19. Zandvakili F, Shahoei R, Roshani D, Nasab LH. Labor induction and the risk of cesarean delivery among term pregnancies. Int J Med Res Health Sci. 2018;5(10):128-33.
20. Sultana R, Begum K, Sultana N, Sultana N, Munmun SA, Ara R, et al. Induction of labour in prolonged pregnancy and its outcome. Med Today. 2015;26(2):100-3.
21. Vahratian A, Zhang J, Troendle JF, Savitz DA, Siega-Riz AM. Maternal prepregnancy overweight and obesity and the pattern of labor progression in term nulliparous women. Obstet Gynecol. 2004;104(5 Pt 1):943-51.

22. Boulvain M, Kelly A, Irion O. Intracervical prostaglandins for induction of labour. Cochrane Database Syst Rev. 2008;(1):CD006971.
23. Davey MA, King J. Caesarean section following induction of labour in uncomplicated first births: a population-based cross-sectional analysis of 42,950 births. BMC Preg Childbirth. 2016;16:92.

Cite this article as: Devarasetty S, Habeebullah S. Maternal factors affecting outcome of induction of labour. Int J Reprod Contracept Obstet Gynecol 2019;8:4705-10.