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**Original Research Article**

# A retrospective study of outcomes of induced labors in a tertiary care hospital in Puducherry

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## ABSTRACT

**Background:** Induction of labor (IOL) is a common obstetric intervention performed when continuation of pregnancy poses greater risk than delivery.
**Methods:** A retrospective observational study was conducted among 120 women who underwent induction of labor over a 6-month period. Data regarding demographic profile, indications, methods, maternal and neonatal outcomes were analyzed.
**Results:** Majority of women were aged 21-30 years (80.8%) and multiparous (55%). Most inductions were performed between 38-40 weeks. Vaginal delivery was achieved in 62.5%, while 30% required cesarean section. Maternal complications were minimal with 1.7% experiencing postpartum hemorrhage. Neonatal outcomes were favorable with 98.3% normal outcomes and minimal NICU admissions.
**Conclusions:** Induction of labor is a safe and effective intervention with good maternal and neonatal outcomes when appropriately indicated and monitored.

**Keywords:** Cesarean section, Induction of labor, Maternal outcome, Neonatal outcome, NICU

## INTRODUCTION

Induction of labor (IOL) refers to the artificial initiation of uterine contractions before the spontaneous onset of labor to achieve vaginal delivery when the benefits of delivery outweigh the risks of continuing pregnancy.[1] It is one of the most commonly performed obstetric interventions worldwide and has become an integral component of modern obstetric practice due to increasing maternal and fetal indications for planned delivery.[2,3] The prevalence of labor induction has risen steadily over the past few decades, accounting for a significant proportion of deliveries in tertiary care centres.

Although induction of labor is an effective strategy for preventing adverse maternal and fetal outcomes in appropriately selected cases, it is associated with certain risks including failed induction, operative vaginal delivery, caesarean section, postpartum haemorrhage, fetal distress, and neonatal intensive care unit admission.[4-7] The success and safety of induction depend on multiple factors such as indication for induction, gestational age, cervical favourability, parity, and induction method used.[8,9] Therefore, careful evaluation and close intrapartum monitoring are essential to ensure favourable fetomaternal outcomes. Assessment of maternal and neonatal outcomes following labor induction is important for evaluating the effectiveness and safety of current obstetric practices,

particularly in tertiary care institutions managing high-risk pregnancies.

The present study was undertaken to evaluate maternal and neonatal outcomes of induced labor in women admitted to a tertiary care hospital and to analyse the demographic profile, indications, and complications associated with labor induction.

### *Aim*

To evaluate maternal and neonatal outcomes following induction of labor in women undergoing induced labor and compare maternal and neonatal outcomes associated with different methods of labor induction- mechanical, pharmacological, and combined approaches in tertiary care hospital.

### *Objectives*

The objectives of the present study were to evaluate the demographic and obstetric profile of women undergoing induction of labor, to identify the common indications and associated antenatal risk factors for induction of labor, and to assess maternal and neonatal outcomes following induced labor.

### *Methods of induction*

Pharmacological methods form the cornerstone of labor induction, with prostaglandin analogues such as misoprostol (PGE1) and dinoprostone (PGE2) widely used for cervical ripening.[10] Evidence suggests that misoprostol demonstrates superior efficacy with comparable safety, achieving higher vaginal delivery rates and shorter induction-to-delivery intervals than dinoprostone.[11] Optimal dosing of misoprostol is 25 micrograms vaginally every 4-6 hours, while higher doses increase the risk of uterine tachysystole without additional benefit.[12] Dinoprostone is administered as intracervical gel or vaginal insert but requires cold storage and is relatively expensive, making misoprostol more suitable for resource-limited settings.[13]

Oxytocin plays a crucial role in labor augmentation following adequate cervical ripening or in cases with a favorable cervix. Early initiation of oxytocin before sufficient cervical readiness increases the likelihood of caesarean delivery, and adequate duration of administration should be ensured before diagnosing failed induction.[14]

Mechanical methods, including transcervical balloon catheters such as Foley and Cook devices, provide effective cervical dilation with minimal systemic effects. These methods are advantageous in specific situations such as outpatient induction and vaginal birth after caesarean due to their safety profile.[15] Combined approaches using both mechanical and pharmacological methods have been shown to reduce induction-to-delivery time compared to single techniques.

The Bishop score remains a widely used tool for assessing cervical favorability, evaluating parameters such as dilation, effacement, consistency, position, and fetal station.[16] Higher scores are associated with increased likelihood of successful vaginal delivery, while lower scores predict prolonged labor and higher cesarean rates. Although newer modalities such as transvaginal ultrasound assessment of cervical length and angle offer improved predictive accuracy, the Bishop score continues to be preferred in clinical practice due to its simplicity and accessibility.[17]

### *Bishop score*

Score ≥8 predicts successful vaginal delivery (>80%) (13). Score <6 is associated with higher LSCS rates.

### *Maternal outcomes following labor induction*

Labor induction is associated with variable maternal outcomes, particularly affecting mode of delivery and complication rates.[18] Cesarean section rates range from 13-54%, although elective induction at 39-40 weeks may reduce caesarean risk in selected populations.[19,20] Successful vaginal delivery occurs in 66-83% of cases, with better outcomes in multiparous women and those with favorable Bishop scores.

Maternal complications include postpartum hemorrhage (11-20%), perineal trauma (20-24%), and infections such as chorioamnionitis, especially with prolonged labor.[21] Uterine tachysystole is more common with prostaglandins but is usually manageable.[22] Despite higher complication rates compared to spontaneous labor, most adverse outcomes are preventable with appropriate monitoring and individualized protocols. Serious maternal morbidity is rare (<1%), though conditions such as uterine rupture and amniotic fluid embolism require prompt recognition and management.[23]

### *Fetal and neonatal outcomes following labor induction*

Labor induction generally shows favorable neonatal outcomes, including reduced low Apgar scores and decreased perinatal mortality compared to expectant management.[24] Meconium-stained liquor is more common, particularly after 40 weeks, and may be associated with fetal distress. NICU admission rates vary from 6-32%, commonly due to birth asphyxia and meconium aspiration.[25] Induction also reduces the incidence of macrosomia and its associated complications.

### *Effectiveness and success rates of various induction methods*

Misoprostol demonstrates higher efficacy than dinoprostone with shorter induction-to-delivery intervals.

Mechanical methods such as balloon catheters offer comparable success with lower risk of hyperstimulation. Combined methods further reduce time to delivery.[26-28] Cervical status remains the key determinant of success, with favorable Bishop scores predicting better outcomes.

### *Factors influencing induction success and adverse outcomes*

Advanced maternal age, primigravida status, and unfavorable cervix are major predictors of failed induction. Obstetric factors such as prior cesarean section and short interpregnancy interval also influence outcomes.[29,30] Although newer ultrasound-based predictors show promise, the Bishop score remains the most practical and widely used tool in clinical practice

## METHODS

### *Study type*

It was a retrospective observational study.

### *Study period*

The study took place from 1st November 2024-30th April 2025

### *Study place*

Department of obstetrics and gynaecology, Sri Venkateshwaraa Medical College hospital and research centre.

### *Study population*

All the patient satisfying the inclusion criteria in the period of this study was included.

### *Sample size collection*

As this is a retrospective study, all eligible patients who satisfied the inclusion criteria during the study period were included. In our institute, we have an average of around 60 deliveries conducted in a month. Considering the rate of induction to be around 30%, approximately 20 patients were induced per month.

As this is a short study, we have taken the duration of study as 6 months. As per the above data, we expect around 120 patients would have undergone induction of labor during our study period (1st November 2024 - 30th April 2025). Hence, we anticipate our sample size to be around 120.

### *Inclusion criteria*

All pregnant women who underwent labor induction within the study timeframe were considered.

### *Exclusion criteria*

Women with spontaneous onset of labor and those who underwent elective lower segment cesarean section were excluded from the study.

### *Method of data collection*

Case sheets of all the patients who delivered between 1st November 2024 to 30th April 2025 were collected from medical record department. From those case sheets patients who had undergone induction of labor were identified. From the patient records basic demographic details like - patient's age, parity, gestation age (in weeks) was collected. Case sheets were further analysed and the following details including indication for induction of labor, BISHOP score at induction, method of induction and augmentation of labor used, FHR pattern during monitoring were noted.

Maternal outcomes including mode of delivery, induction-delivery interval, complications like PPH, hyperstimulation and prolonged labor were noted and analysed. Indication for taking up for caesarean section after induction of labor were noted. Fetal outcomes including birth weight, APGAR score, NICU admission, perinatal mortality were noted from the case sheets. A data entry Performa was used and all the necessary data mentioned above were recorded in it.

### *Statistical analysis*

Data was analyzed using SPSS or other statistical software. Descriptive statistics (mean, standard deviation, frequency, percentage) were used to summarize the data. Categorial variable was expressed as frequency and percentage. Continuous variable was expressed mean and standard deviation.

Independent t-tests (for normally distributed continuous variables) or Mann-Whitney U tests (for non-normal data) were used. Chi-square ($\chi^2$) test or Fisher's exact test was used for categorical outcomes.

### *Ethical approval*

The study was approved by the Institutional Ethics Committee of Sri Venkateswaraa Medical College Hospital and Research Centre, Puducherry. Patient confidentiality was maintained throughout the study.

## RESULTS

Most women belonged to the 21-30 years age group (97, 80.8%), followed by 18-20 years (12, 10.0%) and 31-40 years (11, 9.2%), indicating that induction of labor was most common in the peak reproductive age group.

**Table 1: Age group of the patients.**

| Age group | Frequency | Percent |
|---|---|---|
| **18 to 20 years** | 12 | 10.0 |
| **21 to 30 years** | 97 | 80.8 |
| **31 to 40 years** | 11 | 9.2 |
| **Total** | 120 | 100.0 |

Of the 120 women, 66 (55.0%) were multiparous and 54 (45.0%) were primiparous, showing a slightly higher proportion of induced labor among multiparous women.

**Table 2: Parity of the patients.**

| Parity | Frequency | Percent |
|---|---|---|
| **Multi-para** | 66 | 55.0 |
| **Primi Para** | 54 | 45.0 |
| **Total** | 120 | 100.0 |

Most inductions occurred between 38-39 weeks (51, 42.5%) and 39-40 weeks (47, 39.2%), while 18 (15.0%) were induced at 37-38 weeks and 4 (3.3%) at 40 weeks, indicating that induction was most common between 38 and 40 weeks of gestation.

**Table 3: Gestational age (weeks) of the patients.**

| Gestational age (weeks) | Frequency | Percent |
|---|---|---|
| **37 to 38** | 18 | 15.0 |
| **38 to 39** | 51 | 42.5 |
| **39 to 40** | 47 | 39.2 |
| **40** | 4 | 3.3 |
| **Total** | 120 | 100.0 |

More than half of the women had no antenatal complications (62, 51.7%), while hypothyroidism (18, 15.0%) and gestational diabetes (13, 10.8%) were the most common complications observed.

**Table 4: Antenatal complications.**

| Antenatal complications | Frequency | Percent |
|---|---|---|
| **Hypothyroidism** | 18 | 15.0 |
| **Gestational diabetes** | 13 | 10.8 |
| **Anemia** | 8 | 5.8 |
| **Rh negative** | 7 | 5.0 |
| **Gestational hypertension** | 6 | 4.2 |
| **Oligohydramnios** | 5 | 6.7 |
| **IUGR** | 2 | 1.7 |
| **Pre-eclampsia** | 1 | 0.8 |
| **PROM** | 1 | 0.8 |
| **No complications** | 62 | 51.7 |

The most common indication for induction was term pregnancy (76, 63.3%), followed by oligohydramnios (17, 14.2%) and PROM (10, 8.3%).

**Table 5: Indications for induction of delivery.**

| Indications for induction | Frequency | Percent |
|---|---|---|
| **Decreased fetal movement** | 6 | 5.0 |
| **Gestational diabetes** | 8 | 6.7 |
| **Gestational hypertension** | 2 | 1.7 |
| **IUGR** | 2 | 1.7 |
| **Oligohydramnios** | 17 | 14.2 |
| **PROM** | 10 | 8.3 |
| **Term** | 76 | 63.3 |

**Table 6: Mode of delivery of the patients.**

| Mode of delivery | Frequency | Percent |
|---|---|---|
| **NVD with LMLE** | 75 | 62.5 |
| **LSCS** | 36 | 30 |
| **Vacuum extraction** | 6 | 5 |
| **Forceps delivery** | 3 | 2.5 |
| **Total** | 120 | 100.0 |

Normal vaginal delivery with episiotomy was the most common mode of delivery (75, 62.5%), followed by LSCS (36, 30.0%), vacuum extraction (6, 5.0%) and forceps delivery (3, 2.5%).

**Table 7: Birth weight of the neonates.**

| Birth weight of the neonates | Frequency | Percent |
|---|---|---|
| **LBW** | 10 | 8.3 |
| **Normal birth weight** | 110 | 91.7 |
| **Total** | 120 | 100.0 |

Most neonates had normal birth weight (110, 91.7%), while 10 (8.3%) were of low birth weight.

**Table 8: Maternal and intrapartum complication.**

| Maternal and intrapartum complications | Frequency | Percent |
|---|---|---|
| **Atonic PPH** | 2 | 1.7 |
| **Grade II MSL** | 8 | 6.7 |
| **Grade III MSL** | 2 | 1.7 |
| **No complications** | 108 | 90.0 |
| **Total** | 120 | 100.0 |

The majority of patients had no complications (108, 90.0%), while grade II meconium-stained liquor (8, 6.7%), atonic PPH (2, 1.7%) and grade III meconium-stained liquor (2, 1.7%) were observed.

Most neonates had favourable outcomes (118, 98.3%), with only 2 (1.7%) requiring NICU admission.

**Table 9: Neonatal outcomes.**

| Neonatal outcomes | Frequency | Percent |
|---|---|---|
| **NICU admission** | 2 | 1.7 |
| **Favourable outcomes** | 118 | 98.3 |
| **Total** | 120 | 100.0 |

## DISCUSSION

The present study evaluated outcomes of induced labors in 120 patients at a tertiary care hospital in Puducherry, revealing important insights into maternal and neonatal outcomes that warrant comparison with contemporary published research.

### *Age distribution and parity*

The majority of women in the current study belonged to the 21-30 years age group, accounting for 80.8% of cases, reflecting the peak reproductive age for induced labors. This finding aligns closely with multiple recent studies conducted in tertiary care settings. Tanwar et al reported that 40.36% of induced women were between 26-30 years, while a study from Nepal by Yadav et al found that 75.55% of induced patients belonged to the 20-30 years age group.[24,25] The consistency across these studies suggests that labor induction is predominantly performed during the optimal reproductive years when pregnancy complications requiring intervention are more manageable. Regarding parity, the present study demonstrated 55.0% multiparous and 45.0% primiparous women, showing a marginally higher proportion among multiparous women. Our results correspond closely with a Ugwuoroko et al study at NAUTH where multiparous women demonstrated an 88.9% success rate compared to 58.4% in nulliparous women, and an Ethiopian study by Alayu et al which found that multiparous mothers were 3.01 times more likely to achieve successful vaginal delivery following induction.[26,27] The higher success rate in multiparous women can be attributed to uterine response to induction agents and proven pelvic adequacy from previous deliveries.

### *Gestational age at induction*

The current study found that most inductions occurred between 38-39 weeks (42.5%) and 39-40 weeks (39.2%), with only 15.0% at 37-38 weeks and 3.3% at exactly 40 weeks. This pattern indicates judicious timing of induction in the late-term but not post-term period. A German cohort study by Pfleiderer et al reported that the rate of induction increased from 35.3% to 73.2% with advancing gestational age, reflecting guideline recommendations for antenatal monitoring beyond 41 weeks.[28] Similarly, a Hong Kong study by Ng et al demonstrated that induction of labor at term resulted in a 66.4% vaginal delivery rate, supporting the safety and efficacy of term inductions.[29] The predominance of inductions between 38-40 weeks in our study reflects a balanced approach avoiding both early term complications and post-term risks.

### *Antenatal complications*

In the present study, 51.7% of women had no antenatal complications, while hypothyroidism emerged as the most common complication at 15.0%, followed by gestational diabetes at 10.8%. This finding is particularly noteworthy given the rising prevalence of endocrine disorders in pregnancy. A study from India by Rathod et al found that gestational diabetes was more common in hypothyroid women (8%) compared to euthyroid controls (1%), supporting the relationship between these two endocrinopathies.[30] Furthermore, a comprehensive study by Tirosh et al demonstrated that the combination of diabetes mellitus and hypothyroidism during pregnancy was associated with higher rates of cesarean sections (25% versus controls), preterm deliveries, and hypertensive disorders.[31] The lower rate of pre-eclampsia in our study (0.8%) compared to Tirosh's findings may reflect improved antenatal surveillance and management of these endocrine conditions.

### *Indications for induction*

The commonest indication for induction in our study was term pregnancy at 63.3%, followed by oligohydramnios at 14.2% and premature rupture of membranes (PROM) at 8.3%. This distribution differs substantially from other tertiary center experiences. A Nigerian study by Ugwuoroko et al reported that women induced for hypertensive disorders had 100% success rates, while those with intrauterine fetal death achieved 88.9% success, compared to only 50% success in preterm PROM cases.[26] In contrast, a study from Port Harcourt by Amechi et al found post-dated pregnancy as the leading indication at 25.68%, pregnancy-induced hypertension at 18.92%, and intrauterine fetal death at 13.51%.[32] The relatively lower proportion of PROM at 8.3% in our study compared to other centers may reflect different referral patterns or earlier spontaneous labor onset in PROM cases.

### *Mode of delivery*

The present study achieved normal vaginal delivery with left mediolateral episiotomy in 62.5% of cases, with a cesarean section rate of 30.0%, vacuum extraction in 5.0%, and forceps delivery in 2.5%. This overall vaginal delivery success rate of 70% compares favorably with contemporary literature. A Nigerian tertiary hospital study reported a 71.2% successful induction rate resulting in vaginal delivery, while a study from Ghana using 25 µg misoprostol achieved an impressive 82.1% vaginal delivery rate with only 17.9% requiring cesarean section. The Hong Kong study by Ng et al experience documented a 66.4% vaginal delivery rate among induced patients, closely matching our findings.[29] However, our cesarean rate of 30% is higher than the 24.1% reported in an Indian multi-center study by Ethiraj et al.[33] The differences in cesarean rates likely reflect varying patient populations, with tertiary centers receiving higher-risk referrals. Regarding instrumental deliveries, our combined vacuum

and forceps rate of 7.5% aligns with declining global trends in operative vaginal delivery.

***Birth weight and neonatal outcomes***

The current study demonstrated that 91.7% of neonates had normal birth weight while 8.3% were classified as low birth weight. This predominantly favorable birth weight distribution is consistent with term gestations comprising the majority of inductions. A German study by Pfleiderer et al documented that fetal weight increased significantly with advancing gestational age, supporting the appropriate timing of inductions in our cohort to optimize birth weight outcomes.[28] Regarding neonatal outcomes, our study showed 98.3% favorable outcomes with only 1.7% requiring NICU admission. This excellent neonatal outcome surpasses several comparative studies.

***Maternal outcomes and complications***

Favorable maternal outcomes were observed in 98.3% of cases in the present study, with only 1.7% developing atonic postpartum hemorrhage. This low maternal complication rate compares favorably with published literature. A Port Harcourt study by Amechi et al reported 97.30% of women with no complications, 1.35% with antepartum hemorrhage, and 1.35% with postpartum hemorrhage, nearly identical to our findings.[32] However, our results demonstrate better outcomes than those reported in some other studies where maternal morbidity was higher due to factors such as prolonged labor and failed induction. Regarding overall complications, 90% of patients in our study had no complications, while grade II meconium-stained liquor was noted in 6.7%, grade III meconium in 1.7%, and atonic PPH in 1.7%. The meconium-staining rate of 8.4% (combined grade II and III) in our study is substantially lower than reported in several other studies. An Indian study by Sinha et al documented meconium-stained liquor in 23.7% of induced labors, while a study on post-dated pregnancies reported meconium staining in 42.5% of cases, significantly higher than term pregnancies.[35] A prospective study from India by Sharma et al on meconium-stained liquor found that grade II meconium occurred in the majority of cases, with thick meconium associated with 76% cesarean section rates due to fetal distress.[34]

The present study has certain limitations. As a retrospective observational study, it was dependent on the accuracy and completeness of hospital medical records, which may have introduced information bias. The study was conducted in a single tertiary care centre with a relatively limited sample size, which may restrict the generalizability of the findings to the broader population. In addition, the retrospective design limited control over confounding variables and prevented assessment of long-term maternal and neonatal outcomes. Further prospective multicentric studies with larger sample sizes are recommended to validate the findings of the present study.

## CONCLUSION

This retrospective study analyses foetomaternal outcomes following induction of labor in 120 women and demonstrates that induction is associated with predominantly favourable results. Most women are induced between 38 and 40 weeks, mainly for term pregnancy and oligohydramnios. Vaginal delivery is achieved in nearly two-thirds of cases, indicating good effectiveness of induction methods, while caesarean section is required in less than one-third. Maternal complications are minimal, with atonic postpartum haemorrhage occurring rarely.

Neonatal outcomes are also highly satisfactory, with very low NICU admission rates and a high proportion of normal birth weight babies. These findings show that induction of labor, when appropriately indicated and monitored, is a safe and effective intervention that results in good maternal and neonatal outcomes and achieves the stated aims of evaluating foetomaternal outcome and effectiveness of induction methods.

Induction should be offered at appropriate gestational age with strict selection criteria. Standardized protocols, continuous intrapartum monitoring and timely decision for operative delivery are essential. Training in induction techniques and regular audit of outcomes should be encouraged.

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