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Does induction of labour before the expected date of delivery affect perinatal outcomes? A descriptive study

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Abstract

Introduction: Induction of labor (IOL) is a common obstetric procedure aimed at achieving vaginal delivery. Traditionally, induction is reserved for low-risk pregnancies at 41 weeks but as there is increasing complications associated with increasing gestational age; emerging evidence suggests benefits of earlier induction at around 39 weeks. This study evaluates whether IOL at different term gestational age would affect perinatal outcome that would help to optimize timing of induction.

Method: A total of 279 obstetric patients were induced after 38 weeks gestation over a three-month period. Patients with medical complications requiring distinct protocols were excluded. Outcomes assessed were mode of delivery, indications of Cesarean section, presence of meconium-stained liquor and Neonatal admission.

Result: Among 279 induced women, 52.68% achieved vaginal delivery, remaining had cesarean section (CS) which was higher in primigravida. CS rate decreased significantly with advancing gestational age from 56.06% at 38–39 weeks to 15.90% at >40 weeks. The failed induction was more common at 38-39 weeks of gestation (28.78%) whereas MSL was more frequent among >39 weeks group (16.67%) requiring emergency CS. Neonatal admissions to nursery were higher in 39–40 weeks group but NICU admissions were seen only among >40 weeks group. There was no neonatal death or intrapartum stillbirth among induced patient however two inductions were done for antenatal IUFD that occurred after 40 weeks of gestation who had no known risk factors.

Conclusion: Induction at 39–40 weeks achieves a favorable balance by reducing cesarean section rate and maintaining optimal neonatal outcome.

Keywords: Cesarean section; Failed Induction; Induction at term; Meconium

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Introduction

Induction of labor (IOL) is a common obstetric intervention used to initiate labor to achieve vaginal delivery.[1] Common indications at term include hypertensive disorders of pregnancy, gestational diabetes mellitus, obstetric cholestasis, reduced fetal movement, and post-dated pregnancy. IOL plays a vital role in reducing pregnancy-related maternal morbidity and mortality; however, it may be associated with increased risks such as higher cesarean section rates, uterine hyperstimulation, meconium-stained liquor, fetal hypoxia, and postpartum hemorrhage.

Globally, about 25% of pregnancies are induced, with nearly 20% of them resulting in cesarean delivery, and induction rates have almost doubled since 1990.[2] In the United States, induction rates increased from 9.6% to 27.1% between 1990 and 2018.[3] In Nepal, reported induction rates range from 8.9% to 10.5%.[4,5]

Traditionally, spontaneous onset of labor is awaited in low-risk pregnancy to maximize vaginal birth with minimal intervention; hence, IOL is usually reserved until 41 weeks and endorsed by the World Health Organization (WHO) and the National Institute for Health and Care Excellence (NICE).[6,7] The ARRIVE trial demonstrated lower cesarean section rates with IOL at 39 weeks without an increase in adverse perinatal outcomes.[8] Dutch studies also showed optimal maternal and neonatal outcomes at 39–40 weeks.[9] Based on this evidence, the American College of Obstetricians and Gynecologists (ACOG) endorsed induction at 39 weeks.[10]

The aim of this study is to assess outcomes of induction of labour at different term gestational ages, 38-39 weeks, 39-40 weeks, and beyond 40 weeks, irrespective of associated risk factors, to determine their influence on perinatal outcomes and optimize the timing of induction of labour at term.

Method

This was a hospital based prospective observational study done at the Dept. of Obstetrics and Gynecology at Patan Academy of Health Sciences. The study was approved by institutional review committee (IRC) prior to commencement (Ref. drs2506202029). The study was conducted over three months, from 2025 Jul 17 to Oct 17.

All obstetric patients ≥38 weeks of gestation undergoing induction of labour, irrespective of the indications for induction, were included. Patients like pregnancy with bronchial asthma, heart disease, scarred uterus, twins and prelabour rupture of membrane were excluded as they have different induction protocols. Pregnancy with gestational age <38 weeks and Intra Uterine Growth Restriction (IUGR) were also excluded as these groups are generally induced for more serious morbidity which may affect the course of labour.

Based on the cesarean section rate of 13.3% among induced labours at ≥38 weeks, as reported in a study done in America, the minimum required sample size was calculated to be 265 using a single-proportion formula.[12] A convenience sampling method was employed. During the study period, 279 eligible patients underwent induction of labour and all were included in the study. The final sample size was therefore 279, as it represented all inductions meeting the inclusion and exclusion criteria during the study period.

Eligible patients were counselled regarding the nature and purpose of the study, and written informed consent was obtained prior to enrolment. Data were recorded using a pre-designed proforma following delivery. As per the department protocol, the patients underwent modified biophysical profile prior to the induction. The induction was done with misoprostol 25 microgram per vaginally, in 2 doses 6 hours apart. On following day, their labor was augmented with oxytocin whenever indicated as per our hospital protocol. The patients were monitored and managed as per the labor room guidelines.

The primary outcome studied in this study were mode of delivery and indications of Cesarean section, meconium-stained liquor and Nursery/Neonatal Intensive Care Unit (NICU) admission. The secondary outcomes studied were fetal birth weight and perinatal mortality. The proforma was filled following the delivery. Regarding neonatal admission, the baby was monitored until discharge and noted if they were admitted to Nursery ward or NICU.

Result

During the study period, 1271 women had delivered on our institution. Among them, 320(25.18%) underwent induction of labor at ≥37 weeks of gestation. Out of these, only 279 fulfilled the inclusion and exclusion criteria and were included in the final analysis.

The study population consisted of279 patients among which 147(52.69%) had vaginal deliveries and 132(47.31%) had cesarean section. There were 181(64.87%) primigravidae and 98 (35.12%) multigravida in our study cohort. The mean age was 28.05 years and 30.69 years for primigravidae and multigravida, respectively.

The most common indication for induction of labour was subclinical hypothyroidism 54(19.35%), gestational diabetes 49(17.56%) and postdated pregnancy 45(16.13%), Table 1.

The study cohort was stratified into three gestational

Table 1. Indications for induction of labour (N=279)

Indication	n (%)
Subclinical hypothyroidism	54(19.35)
Gestational diabetes mellitus	49(17.56)
Postdated pregnancy	45(16.13)
Decreased fetal movement	26(9.32)
Oligohydramnios	24(8.60)
Liver disorders (Transaminitis / Obstetric cholestasis)	14(5.02)
Pregnancy-induced hypertension / Chronic hypertension	14(5.02)
Indeterminate labour	15(5.38)
PUPPP	5(1.79)
Large for gestational age	7(2.51)
Systemic lupus erythematosus (SLE)	2(0.72)
Bilateral fetal hydrocele (B/L fetal HDN)	4(1.43)
IVF pregnancy	1(0.36)
Class III obesity	1(0.36)
Long birth spacing	1(0.36)
Previous IUFD	2(0.72)
Total	279(100.00)

age groups; 38–39 weeks, 39–40 weeks, and >40 weeks. Among them, 126(45.16%) patients were induced at the gestational age of 38-39 weeks, 91(32.61%) patients at 39-40 weeks and 62(22.22%) patients at gestational age >40 weeks. Amongst the primigravidae females, 109(60.22%) underwent cesarean section. And, amongst the multigravida, 75(76.53%) had vaginal delivery, Table 2.

In the gestational group of 38-39 weeks, 61(21.86%) of primigravidae underwent cesarean deliveries. While only one third of the multigravida underwent cesarean deliveries. In case of >40 weeks of gestational age group, vaginal deliveries were predominant both in case of primigravidae and multigravida, Table 2.

Among the females undergoing cesarean section following the induction of labour,

Table 2. Mode of delivery by gestational age and parity (n = 279)

Gestational age	Primigravidae		Multigravidae		Total, n (%)
	Vaginal, n (%)	CS, n (%)	Vaginal, n (%)	CS, n (%)	
38–39 weeks	26(9.32)	61(21.86)	26(9.32)	13(4.66)	126(45.16)
39–40 weeks	24(8.60)	30(10.75)	30(10.75)	7(2.51)	91(32.61)
>40 weeks	22(7.88)	18(6.45)	19(6.81)	3(1.08)	62(22.22)
Total	72(25.81)	109(39.07)	75(26.88)	23(8.24)	279(100.00)

Table 3. Indications for cesarean section by gestational age and parity (N=132)

Gestational age & parity		Failed induction, n (%)	Fetal heart rate abnormality, n (%)	Meconium-stained liquor, n (%)	Non-progress of labour, n (%)	Total CS n (%)
38–39 weeks	Primigravidae	38(28.79)	16(12.12)	4(3.03)	8(6.06)	61(46.21)
	Multigravidae	4(3.03)	8(6.06)	1(0.76)	-	13(9.85)
39–40 weeks	Primigravidae	7(5.30)	8(6.06)	9(6.82)	6(4.55)	30(22.73)
	Multigravidae	2(1.52)	1(0.76)	4(3.03)	-	7(5.30)
>40 weeks	Primigravidae	4(3.03)	3(2.27)	7(5.30)	3(2.27)	18(13.64)
	Multigravidae	-	-	2(1.52)	1(0.76)	3(2.27)
	Total	51(38.63)	36(27.27)	27(20.45)	18(13.63)	132(100.00)

Table 4. Meconium-stained liquor among induced patients (n = 52)

Mode of delivery	Severity	38–39 weeks, n (%)	39–40 weeks, n (%)	>40 weeks, n (%)	Total, n (%)
Vaginal delivery	Mild	4(7.69)	8(15.38)	6(11.54)	18(34.62)
	Moderate	-	-	5(9.62)	5(9.62)
	Thick	-	-	2(3.85)	2(3.85)
Caesarean section	Moderate	-	5(9.62)	11(21.15)	16(30.77)
	Thick	5(9.62)	0(0.00)	6(11.54)	11(21.15)
Total		9(17.31)	13(25.00)	30(57.69)	52(100.00)

Table 5. Neonatal outcomes by mode of delivery and gestational age (n = 19 affected neonates)

Neonatal outcome	38–39 weeks, n (%)	39–40 weeks, n (%)	>40 weeks, n (%)	Total, n (%)
Nursery admission	6(31.57)	8(42.10)	3(15.78)	17(89.47)
NICU admission	-	-	2(10.52)	2(10.52)
Total affected neonates	6(31.57)	8(42.10)	5(26.31)	19(100.00)

failed induction was the most common indication in 51(38.63%), followed by fetal heart rate abnormality 36(27.27%), meconium-stained liquor and non-progression of labour, Table 3.

Among all these females, failed induction, 38(28.79%) was the most common indication in primigravidae at 38-39 weeks of gestation, followed by fetal heart rate abnormality, 16(12.12%). Fetal heart rate abnormality included fetal bradycardia, fetal tachycardia and nonreassuring NST. Also, the primigravidae females were found to have the higher caesarean section after induction of labour, highest being in 38-39 weeks of gestation, Table 3.

There were 52(18.63%) cases found to have meconium-stained liquor (MSL), among which 27(51.92%) required emergency caesarean section. The occurrence of MSL was highest, 30(42.31%) in pregnancies with >40 weeks of gestation. Among caesarean deliveries for MSL, 16(30.77%) cases were moderate and 11(21.15%) thick, whereas among vaginal deliveries, 18(34.62%) cases were mild, five (9.62%) moderate, and two (3.85%) thick, Table 4.

Among the 279 women induced after 38 weeks, the average birth weight of their newborns was 3123 g, increasing with gestational age: 3046 g at 38–39 weeks, 3147 g at 39–40 weeks, and 3247 g at >40 weeks.

Among the 19 affected neonates, 17(89.47%) were admitted to the nursery and 2(10.52%) required NICU care. Nursery admissions were primarily for tachypnea, low Apgar scores, suspected sepsis, glucose monitoring, neonatal asphyxia, and post-shoulder dystocia care. NICU admissions were due to severe birth asphyxia and cephalohematoma following vacuum delivery. There were two (9.52%) cases of intrauterine fetal demise (IUFD) which occurred at 40+2 and 40+4 weeks, without identifiable risk factors. The highest number of neonatal admissions occurred in the 39–40 weeks gestational age group, 8(38.10%) There were no intrapartum stillbirths or neonatal mortality among the study population, Table 5.

Discussion

This study tends to elucidate if earlier induction of labour before due date would affect the perinatal outcome which would help to optimize the optimal timing for induction. The main outcomes studied were mode of delivery, presence of meconium-stained liquor (MSL), and neonatal admissions to nursery or NICU. Our results indicate that induction at 39–40 weeks gestation achieves a better balance between minimizing cesarean delivery rates and maintaining favorable neonatal outcomes, particularly in primigravidae.

Among 279 study populations, 64.87% were primigravida and 35.12% were multigravida. The highest population with 46.67% was induced at 38 – 39 weeks of gestation. Regarding the mode of delivery, 52.68% had vaginal delivery which was comparable to a study done in eastern Nepal where it was 57.78%.[13] The CS rate was 47.31% and was higher in primigravida (82.57%) then multigravida (17.42%). The high CS rate among primigravida is due to no prior labour experience that leads to slow progression of labour and also the rate of cervical collagen fiber dissolution among them is harder to attain.[14] This CS rate was higher than the prospective cohort study conducted in Pennsylvania, where the CS rate was 35.9% among induced patient. But as in our study, their high CS rate was irrespective to the indication of induction as the indication of CS was mainly the intrapartum factors like unfavourable cervix at the time of induction, labour dystocia and fetal intolerance to labour.[15] Though the CS rate is higher than recommended by WHO in our study, there has been newer method of labour monitoring especially by labour care guide (LCG) which could reduce the CS rate. A study done in India regarding the utilization of LCG reduced the crude absolute risk for CS by 5.5% among 26,331 study populations.[16]

Among the total Cesarean section, highest CS of 56.06% was noted at 38-39 weeks of gestation. Similarly, among all induced primigravida and multigravida, the highest CS was also noted at 38-39 weeks of gestatation with 33.7% and 13.26% respectively. However, the indications of CS were different as the gestational age advanced. The highest frequency of indications for CS before 39 weeks was failed induction (28.78%) whereas the highest frequency after 39 weeks was MSL (16.67%). High incidence of failed induction in early term and fetal distress in late term period as seen in this study was also noted in other studies.[17,18] The higher incidence of failed induction among earlier gestational age, especially before 39 weeks, frequently coincide with a less favorable cervix and lower endogenous oxytocin sensitivity. The incidence of abnormal fetal heart rate requiring CS was 18.18% and 9.09% among patients before and after 39 weeks of gestation respectively. As more compromised pregnancy tends to be induced earlier, these fetuses are less tolerant to labor induction. Thus, they tend to manifest by presenting abnormal fetal heart rate pattern during induction.

The presence of MSL in amniotic fluid progressively increases from 6.4% at 37 weeks to 24.4% by 41 weeks.[19] The major causes of MSL are fetal gut maturation, fetal hypoxia and intraamniotic infection. The present study identified MSL in 18.63% of all induced patients, with a substantial proportion (51.92%) of these cases necessitating emergency

cesarean section due to fetal compromise. This finding indicates a clinically relevant association between induction of labor and the occurrence of meconium passage, particularly at later gestational ages. The highest proportion of MSL peaked beyond 40 weeks aligning with existing evidence that post-term pregnancy increases the risk of meconium passage due to progressive placental senescence and fetal hypoxic stress.[20] Different grades of MSL further highlights the relationship between severity and mode of delivery.[19] Among women who underwent cesarean section, the majority had moderate or thick meconium, suggesting that increasing density correlates with heightened fetal distress prompting surgical intervention in contrast to most women who delivered vaginally had only mild meconium. The rate of MSL among emergency cesarean sections following induction was 20.45% whcih reinforces the need for vigilant intrapartum monitoring in induced labour, particularly as cervical ripening and oxytocin augmentation may predispose fetuses to transient hypoxia.

The average birth weight of newborns among women induced after 38 weeks gestation was 3123.24 grams, ranging widely from 2072 to 4300 grams. Stratification by gestational age showed a progressive increase in mean birth weight: 3046.44 g at 38–39 weeks, 3146.89 g at 39–40 weeks, and 3247.04 g beyond 40 weeks, with a mean difference of 200.6 g between the earliest and latest groups. This trend aligns well with established physiological understanding and recent literature showing consistent fetal weight gain with increasing gestational age in the late-term period.[21] The increment in birth weight with increasing gestational age at term supports the concept of higher incidence of shoulder dystocia and instrumental delivery among late term pregnancy as noticed in this study. After 39 weeks of gestation, the composite neonatal outcome progressively increases from 4.33 per 1,000 live births to 6.96 per 1,000 live births.[22] In this study Neonatal admission to nursery and NICU among induced pregnancy was 6.3% and 0.07% respectively which was comparable to other study where the NICU admission was 2.07%.[23] The highest number of admissions to nursery occurred in 39–40 weeks group whereas the NICU admissions were noted in > 40 weeks group. This highlights the importance of severe neonatal morbidity among deliveries as the date of delivery progresses. In a study conducted in Netherlands, the risk of neonatal death was higher than the risk of stillbirth at 37 and 38 weeks' gestational age and from 40 weeks onward, the risk of stillbirth was higher than the risk of neonatal death.[9] Similar to this study, there were two antenatal intrauterine fetal demise (IUFD) noted after 40 weeks of gestation however no still birth or neonatal death was noted among induced patient.

The principal limitation of this study lies in its descriptive design, which restricts the capacity to draw causal inferences or provide comparative analysis. Although it provides valuable insight into induction related complications, further prospective and comparative studies including low risk pregnancies are required to refine and substantiate these findings

Conclusion

Overall, these findings reinforce the need for careful fetal growth monitoring and risk assessment in pregnancies undergoing induction. Even though induction at or after 40 weeks is meant to reduce perinatal risks, unexpected complications can still happen, reflecting the complex nature of late-term pregnancies. Timely induction of low risk pregnancy thus mitigates the severe unseen fetal complications associated with advancing gestational age.

Conflict of Interest

None

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Author Contribution

Concept, design, planning: PS; Literature review: PS; Data collection/analysis: PS, SS; Draft manuscript: PS, SS; Revision of draft: PS; Final manuscript: PS; Accountability of the work: PS, SS.

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