

# Analysis of Classification Systems and Outcome of Labor in Women Undergoing Induction of Labor in South Indian Population

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## ABSTRACT

**Aim and objective:** To identify women undergoing induction of labor (IOL) for 1 year in our tertiary care hospital, apply the classification systems, correlate with the maternal and fetal outcomes, and determine the ease and effectiveness of audit of the IOL practice.

**Materials and methods:** All patients who delivered in the year 2019 were analyzed, and the cohort of women who underwent IOL was identified. The age, parity, gestational age at induction, indication for induction, and the maternal and fetal outcomes were analyzed. The two classification systems were applied and the results were analyzed.

**Results:** The total number of deliveries for the year was 3,668, and the number of women undergoing IOL was 1,450, with an incidence of 39.5%. The maximum number of women, 1,212, (83.5%) were in the 20–30-year age-group; in that, 1107 (76.34%) were primiparous and 343 (23.66%) were multiparous. The commonest indication for IOL was postdates, with the commonest mode being PGE2 gel in 699 (48.2%) women. Of 1,450 women induced, 1,083 (74.69%) had a vaginal delivery and 367 (25.31%) delivered by a cesarean section. This was similar to the rate seen in women with spontaneous labor. Further, a 10-group classification system according to Nippita et al. and classification of IOL according to the indication for induction proposed by Mahomed et al. was applied to this cohort.

**Conclusion:** The classification systems are useful to determine whether the induction is done according to the established guidelines and makes our audit easier. A prospective audit would better identify some of the adverse maternal and fetal outcomes.

**Clinical implications:** The safety of IOL in modern obstetrics should not give us a false sense of security, and regular audits of the practice of IOL are useful to ensure that the adherence is according to the established guidelines.

**Keywords:** Cesarean section, Labor induction, Neonatal outcome, Obstetric complications, Obstetric outcome, Preinduction cervical ripening. *Journal of South Asian Federation of Obstetrics and Gynaecology* (2021): 10.5005/jp-journals-10006-1940

## INTRODUCTION

Induction of labor (IOL) is one of the most commonly performed interventions in obstetrics. It is indicated that the risks of continuing the pregnancy outweigh the risks associated with the induction process.

Globally labor is induced in about 20–30% of all deliveries for a variety of reasons.<sup>1</sup> Although induction is generally considered a safe process, there are still some concerns like increased rate of tachysystole and the requirement for increased monitoring in labor and epidural analgesia. In addition, there are concerns that delivery by cesarean section for failed induction, failure to progress, or fetal distress and postpartum hemorrhage (PPH) may also be increased. These risks may be inherent to the induction process and may be justified provided that the maternal or fetal risks of continuing the pregnancy outweigh these risks.

Analysis of induction rates is part of the monthly audit of performance indicators carried out in the Department of Obstetrics and Gynaecology in a teaching hospital in South India with a moderately busy obstetric unit of 3,500–3,700 deliveries per year.

However, the audit was proved to be difficult as the monthly rates were variable and monitoring the rates and outcome did not contribute significantly to the measures to improve the quality of care.

A classification system for women undergoing IOL has been proposed by Nippita et al.<sup>2</sup> based on parity, the number of fetuses, and gestational age. Mahomed et al.<sup>3</sup> proposed a classification

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system, incorporating the primary indication for induction in addition to the gestational age.

This retrospective study was undertaken to analyze women undergoing IOL for 1 year period from January 2019 to December 2019. Both classification systems were applied, and the outcome of labor was analyzed.

## AIM AND OBJECTIVE

To identify women undergoing IOL for 1 year, apply the two classification systems, correlate with maternal and fetal outcomes, and determine the ease and effectiveness of audit of the IOL practice.

## MATERIALS AND METHODS

Approval from the institutional human ethics committee was obtained (IHEC Project No 18/277) for a retrospective observational study.

This study was done at a teaching hospital in South India with a moderately busy obstetric unit, with 3,500–3,800 deliveries per year. We are involved in teaching undergraduate and postgraduate as well as nursing students. The hospital also acts as a referral center for high-risk patients from the surrounding clinics. All patients who delivered between January 1, 2019, and December 31, 2019, were analyzed, and the cohort of women who underwent IOL was identified. The age, parity, gestational age at induction, indication for induction, and the maternal and fetal outcomes were analyzed. The two classification systems were applied, and the results were analyzed to determine if the audit is easier and more effective.

## RESULTS

The total number of deliveries for 1 year from January 1, 2019, to December 31, 2019, was 3,668.

The number of women undergoing IOL during this period was 1,450, with an incidence of 39.5%.

The age distribution of patients undergoing IOL was analyzed, and it was found that the largest number of women 1,212 (83.5%) was in the 20–30-year age-group. Twenty-three (1.5%) women were above 35 years and 68 (4.6%) were less than 20 years of age.

Of the 1,450 induced patients, 1,107 (76.34%) were primigravida and 343 (23.66%) were multigravida.

Table 1 shows the indication for IOL, and it was found that the commonest indication was postdates and premature rupture of membranes followed by fetal growth restriction (FGR) and diabetes complicating pregnancy.

The primary mode of induction in this cohort was based on the Bishop score at the time of induction<sup>4</sup> and the commonest mode was PGE2 gel in 699 (48.2%) women followed by oral misoprostol in 566 (39%), and 74 (5.1%) were induced by mechanical methods.

**Table 1:** Indications for IOL

Indications for IOL	No of patients	Percentage
Postdates/estimated date of delivery (EDD)	413	28.48
PROM	338	23.31
FGR	181	12.4
Gestational diabetes mellitus (GDM)/overt DM	181	12.4
Preeclampsia/chronic hypertension (HT)	82	5.65
Social	114	7.86
Oligohydramnios	66	4.5
Polyhydramnios	13	0.89
Intrauterine fetal demise (IUFD)	17	1.17
BOH	17	1.17
Fetal anomaly	6	0.41
Rh isoimmunization	8	0.55
Elderly primi	2	0.13
Others (hypertrophic obstructive cardiomyopathy (HOCM), bipolar disorder, antepartum haemorrhage (APH) <i>in vitro</i> fertilization (IVF), sickle cell disease)	12	0.82

The number of patients who received epidural analgesia in this group was 189 (13%). Patients in spontaneous labor during the study period were 1,671; of which 135 (8%) required epidural analgesia. This difference was statistically significant ( $p$  value 0.001). The mode of delivery in women who were induced was analyzed, and of 1,450 women, 1,083 (74.69%) had a vaginal delivery and 367 (25.31%) delivered by a cesarean section. Women who had spontaneous labor during the same period were analyzed and the rate of cesarean section was found to be 25.37% which was similar to those who had induced labor.

Flowchart 1 shows the 10-group classification system according to Nippita et al.<sup>2</sup> and Flowchart 2 shows that this cohort was divided into groups according to this classification system.

Tables 2 and 3 show primigravida and multigravida classification according to the indication for induction and gestational age.

Table 4 shows the outcome of babies at birth which was analyzed according to the Apgar scores at birth and at 5 minutes and the rate of NICU admissions. The number of babies with an Apgar equal or less than 6 was 72 (4.9%), and the number of NICU admissions in patients undergoing IOL at different gestational ages was 96 (6.62%). The most common reason for an NICU admission was for preterm care in 59 (4.06%) neonates and 11 (0.75%) were admitted for meconium-stained amniotic fluid.

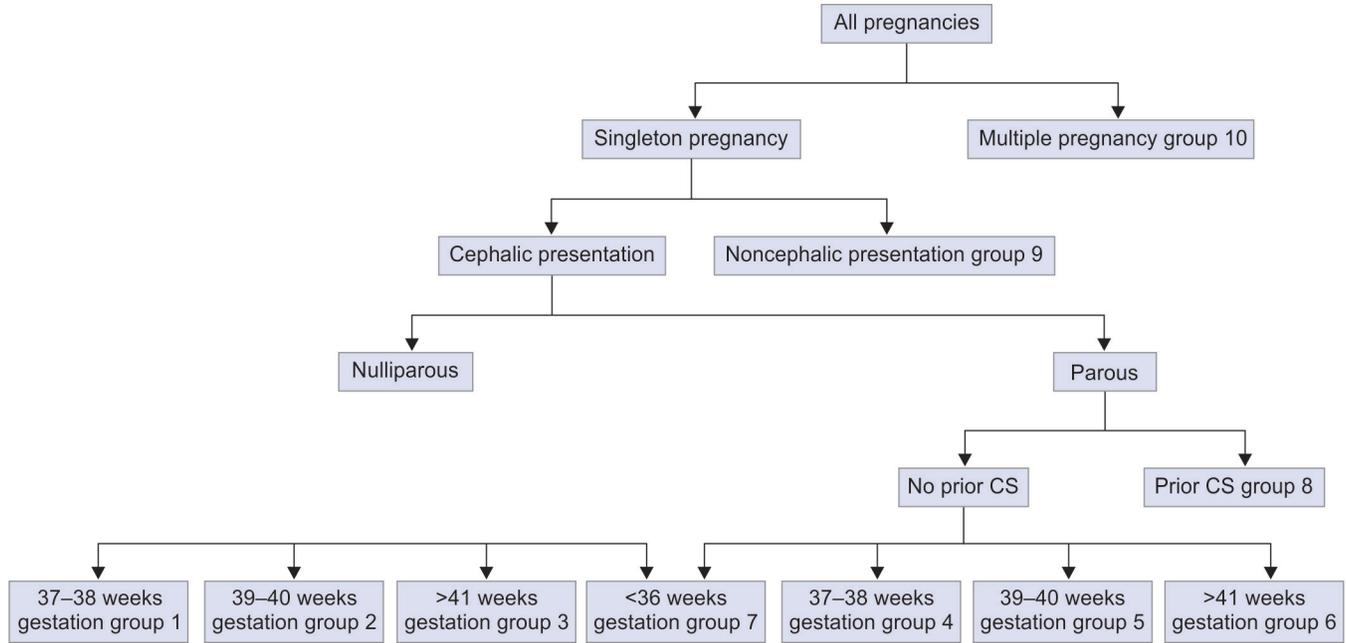
## DISCUSSION

Induction of labor (IOL) is one of the most commonly performed interventions in obstetrics. The increasing effectiveness and safety of induction have resulted in increased rates of induction for many reasons including social reasons for the convenience of the patient and the obstetrician or to ensure that the majority of deliveries are in the daytime when staffing is at its maximum.

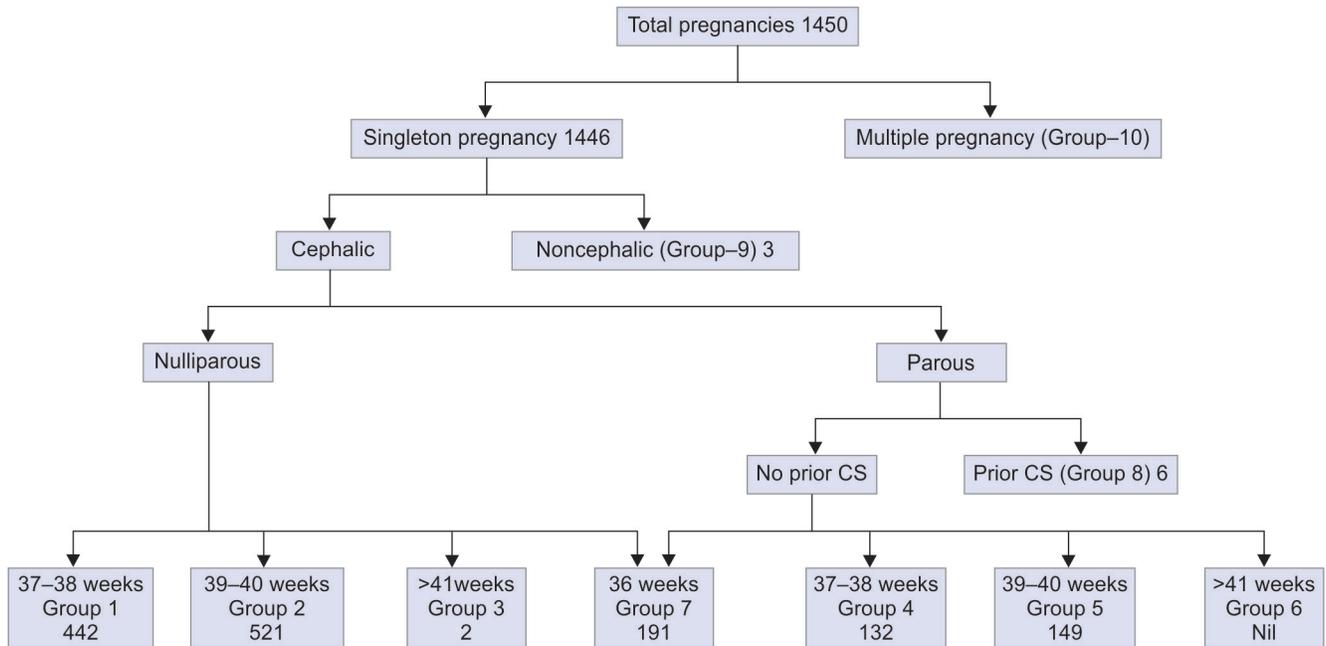
The percentage of patients undergoing IOL is one of the key performance indicators of an obstetric unit.<sup>5</sup> Hence, an audit of this practice is important for two reasons. The first is to ensure that the intervention is according to the established guidelines.<sup>6</sup> The second is to determine if there are adverse maternal or fetal outcomes associated with the intervention. IOL also has a significant impact on women's experience of labor and delivery.<sup>7</sup> However, the audit of women undergoing IOL is not easy as it includes not only the rate of induction but also the indication for induction, the gestational age at which the indication was undertaken, and the maternal and fetal outcomes. Hence, the classification of women undergoing IOL would be helpful in the audit as well as useful in following the practice of induction over time.

Analyzing our results, we found that our induction rate during this period was 39.5%. Comparing this with reported rates of induction, we found that the NHS Maternity Statistics UK 2013–2014 reported that the rates of induction have increased over a 10-year period from 15.4% in 2003–2004 to 21.2% in 2013–2014.<sup>8</sup> The rates of IOL for a singleton pregnancy were reported as 23.8% in the United States in 2010.<sup>9</sup> The rate of induction in Canada has steadily increased from 12.9% in 1992 to 21.8% in 2004 and has since remained steady.<sup>4</sup> Unpublished data from the WHO Global Survey on Maternal and Perinatal Health which included 373 healthcare facilities in 24 countries and nearly 300,000 deliveries showed that 9.6% of deliveries involved labor induction. Overall, the survey found that facilities in African countries tended to have lower rates of IOL (lowest Niger 1.4%) compared with Asian and Latin-American countries (highest Sri Lanka 35.5%).<sup>1</sup>

**Flowchart 1:** Hierarchical nature of the 10-group classification system of IOL proposed by Nippita et al.



**Flowchart 2:** Classification of study group according to Nippita et al.



On analyzing the indication for induction, it was found that postdates (28.48%) and premature rupture of membranes (23.31%) were the commonest indications followed by FGR (12.4%) and diabetes in pregnancy (12.4%). In addition, in 114 patients (7.8%), the indication was social. This was a significant number and included patients who requested delivery on an auspicious day or complained of decreased fetal movements or false pains and were anxious about the outcome.<sup>10</sup> It is important to ensure that, in this group, IOL is done only after 39 weeks.<sup>11</sup> According to Mast et al., the indications for induction included fetal indications, like

FGR, macrosomia, diabetes, postterm pregnancy, and (premature rupture of membranes) PROM. The maternal indications included hypertension, previous CS, and maternal request.<sup>12</sup>

Nippita et al. in 2015 published a systematic review including seven studies that categorized women according to the presence or absence of varying medical indications for IOL. A classification system of 10 groups was developed based on parity, gestational age, and the number and presentation of the fetus.<sup>2,13</sup> Flowchart 2 shows the cohort classified according to this classification system. It was found that the largest number of 521

**Table 2:** Primiparous women. Indication for IOL according to gestational age

Indication for IOL	24–28	28 + 1–36 + 6	37–38 + 6	39–40	>40 weeks	>41 weeks
Postdates/EDD	—	—	—	125	191	2
PE/CH HT	1	29	29	7	—	—
DM/GDM	—	2	98	28	4	—
FGR/SGA	—	30	97	12	—	—
BOH/APLA	—	1	8	—	—	—
IUFD	—	4	3	3	—	—
PROM	1	58	136	71	2	—
Rh neg/ISO	—	—	3	—	—	—
Oligo	—	11	22	19	—	—
Fetal anomaly	—	1	3	1	—	—
Social	—	—	35	50	—	—
Poly	—	—	4	7	—	—
Elderly gravida	—	—	2	—	—	—
Others	—	3	2	2	—	—

**Table 3:** Multiparous women. Indication for IOL according to gestational age

Indication for IOL	24–28	28 + 1–36 + 6	37–38 + 6	39–40	>40 weeks	41+
Postdates/EDD	—	—	—	39	56	—
PE/CH HT	—	9	7	—	—	—
DM/GDM	—	3	34	11	1	—
FGR/SGA	—	12	26	4	—	—
BOH	—	2	6	—	—	—
IUFD	—	6	—	1	—	—
PROM	3	18	29	18	2	—
Rh/isoimmunized	—	1	4	—	—	—
Oligo	—	2	8	4	—	—
Fetal anomaly	—	—	1	—	—	—
Social	—	—	15	14	—	—
Poly	—	1	—	1	—	—
Others	—	—	4	1	—	—

**Table 4:** Neonatal outcomes

Gestational age in weeks	Apgar scores < or = 6	No of NICU admissions
<28 weeks	3	3
28–37 weeks	24	56
37–40 weeks	31	26
>40 weeks	14	11

(35.93%) was in group 2 which was nulliparous women between 39 and 40 weeks. This is similar to the results by Nippita et al., where they found that nulliparous and parous women at full term were the largest groups 21.2 and 24.5%, respectively. Group 1 that includes nulliparous women between 37 and 38 weeks had 442 (30.5%) patients. However, it was difficult to audit this group without including the indication for induction. Many of our patients were induced at 40+ weeks under the premise that southeast Asian babies tend to mature earlier. These women who were induced at 40 + 1 to 40 + 6 weeks were included in groups 2 and 5, respectively. Group 8 (previous CS), group 9 (noncephalic), and group 10 (multiple pregnancies) had only 6, 3, and 4 patients, respectively. The noncephalic group was mainly induced for intrauterine fetal death.

On auditing this cohort, we were able to determine that the largest numbers were in groups 2 and 5 of about 670 (46%). This included both primi- and multigravida at 39–40 + 6 weeks. Patients >41 weeks were placed in groups 3 and 6 which had very small numbers.

Tables 2 and 3 show primigravida and multigravida classification according to the indication for induction and the gestational age at which it was carried out as proposed by Mahomed et al.<sup>3</sup> They found that the commonest indication for IOL was postdates which accounted for 27.6%. The advantage of including the indication for IOL is two-fold. For most of the indications included in their list, there are evidence-based guidelines, and we can determine if we are adhering to these guidelines.<sup>4,14</sup> Secondly, we can concentrate on areas for improvement targeted at a specific group rather than the entire population. On analyzing our cohort, we found that the largest group of patients (674) was induced between 39 and 41 weeks. In patients who were induced before 37 weeks, the indication for induction like preeclampsia or PROM helped to determine whether the induction was appropriate.

Although IOL is a safe procedure, an audit of the process would be incomplete without including the maternal and fetal outcomes.<sup>15</sup> On analyzing the mode of delivery, we found that 1,083 women (74.69%)

had a vaginal delivery. The incidence of a cesarean section was 25.31% which is similar to the rate in the spontaneous labor group (25.37%); however, a meta-analysis of various RCTs was done by Mishanina et al. and showed that the risk of cesarean section was lower among the women whose labor was induced than those managed expectantly.<sup>16</sup> The need for epidural analgesia in our cohort was higher in those induced compared to those in spontaneous labor which was similar to the data published by Poma et al.<sup>17</sup> but the duration of labor could not be compared in our study as it is a retrospective study.

On analyzing the fetal outcome, we found that babies with an Apgar score equal to or less than 6 were 72 (4.9%) and the number of NICU admissions was 96 (6.62%) which was comparable to women with spontaneous onset of labor.<sup>18</sup>

## CONCLUSION

A regular audit of labor ward practice to measure compliance against standards is important to ensure the quality of care. However, an audit of IOL is not easy as many factors have to be taken into account. Classifying the cohort of women undergoing IOL into groups would make the process easier and more standardized. The 10-group classification is based on parity and gestational age and helps divide the cohort into specific groups. The addition of the indication for IOL would add value to ensure that IOL is done according to the established guidelines. So, the classification systems are useful to determine whether the IOL is done according to the established guidelines. However, the second part of the audit to determine whether there are adverse maternal or fetal outcomes associated with the intervention would include factors like the duration of labor, mode of delivery, maternal complications like tachysystole or PPH and fetal complications like decelerations in labor or meconium-stained amniotic fluid. Some of these factors are best identified in a prospective audit and would what is ideal if circumstances permit. The safety of IOL in modern obstetrics should not give us a false sense of security and we should take all measures to ensure that our practice is according to the highest standards.

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