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Edited by Neelam Goyal & Shruti Dabi
E-mail: dr.neelamgoyal15@gmail.com & shrutidabi59@gmail.com; Phone +91 98188 24219
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Factors affecting failed induction of labour among Indian women

Vaishnavi S Raghoji*, Rajkumar P Patange & Supriya Patil

Department of Obstetrics and Gynecology, Krishna Institute of Medical Sciences, Karad - 415110, Maharashtra, India; *Corresponding author

Affiliation URL:
https://kvv.edu.in/

Author contacts:
Vaishnavi S Raghoji - E - mail: raghojivaishnavi777@gmail.com
Rajkumar P Patange - E - mail: rppatange@hotmail.com
Supriya Patil - E - mail: supriyanarakepatil@gmail.com

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Abstract:
Medical personnel are typically worried when an induction of labour fails. Therefore, it is of interest to evaluate the factors leading to forced internal labor (FIOL). 92 patients were divided into 2 groups namely, group A - filed induction (FI) and group B - successful induction (SI) to collect information with the help of questionnaire, clinical assessment and laboratory findings. We found that, the presence of Oligohydramnios (OGD) does not significantly impact the success of labor induction between the 2 groups. (P = 0.459) Thus, data highlights the importance of considering age, parity, gestational age (GA), Bishop Score and BMI for optimizing labor induction (LI).

Keywords: Forced internal labor (FIOL)**,** labor induction (LI), filed induction (FI), successful induction (SI), oligohydramnios (OGD), questionnaire, clinical assessment and laboratory findings.

Background:
Induction of labor (IOL) is a commonly used procedure in modern obstetrics. It involves the artificial stimulation of uterine contractions after 28 weeks of gestation, but before labor begins naturally, with the goal of facilitating a vaginal delivery **[1, 2].** It is only when the benefits of terminating the pregnancy outweigh the risks of continuing it that an IOL, a potentially life-saving obstetric procedure, is advised **[3].** The selection of induction techniques, whether they involve medication, mechanical methods, or a combination of both, can play a crucial role in determining the outcome of the induction process. There are several commonly used techniques for labor induction, including the mechanical approach using an ARM and balloon catheter, as well as the pharmacologic approach using oxytocin and misoprostol **[1, 4].** However, a variety of suggested criteria for detecting FIOL exist, including the mode of delivery (cesarean versus vaginal) and precise time intervals in which the active phase of labor is achieved or an adequate number of uterine contractions **[5].** The Federal Ministry of Health of Ethiopia (FMOH) defines failure to generate adequate uterine contractions (3-5C/10min/≥40s) after 6 to 8 hours of oxytocin infusion at the maximal dosage as FIOL **[6].** On the other hand, the majority of other studies defined FIOL as the inability to give birth vaginally or by cesarean section (CS) **[7, 8].**

Approximately 20% of pregnancies globally are affected by IOL2, with around 20% of these pregnancies ultimately leading to cesarean section deliveries **[9].** In industrialized nations, around 25% of deliveries involve induction of labor (IOL). Interestingly, in some developing countries, the rate of IOL is comparable to that of developed nations, ranging from 1.4% in Nigeria to 35.5% in Sri Lanka. According to a source cited as **[10]**. It is widely acknowledged that IOL plays a crucial role in reducing maternal morbidity and mortality associated with pregnancy and its complications. Unfortunately, IOL doesn't always yield the desired results. In some cases, it can lead to emergency cesarean delivery (CS delivery), which has been associated with various negative consequences for both the mother and the newborn. These include postpartum hemorrhage (PPH), hysterectomy; wound complications, sepsis **[11]**, injuries to the newborn, maternal death **[12, 13]** and longer recovery periods **[14, 15].** Induced labor is associated with a greater likelihood of caesarean sections and other surgical deliveries when compared to spontaneous labor in women **[12].** According to a study done at Mattu Karl Hospital in Ethiopia, FIOL had a negative impact on 6.5% of women and 35.5% of neonates **[12].** Therefore, it is of interest to report the prevalent factors associated with failed induction of labour (FIOL).

Materials and Methods:
The current retrospective observational study was conducted in the department of obstetrics and gynecology at Krisna Vishwa Vidyapeeth Hospital starting from June 2022 ending to November 2023 with a total of 92 patients. These patients were further divided into 2 groups, *i.e.,* group A included cases with FI, while group B included cases with SI with 46 patients each, respectively. Upon admission for IOL, eligible women were approached for participation. Data was collected with the help of structured questionnaire which includes demographic data, obstetric history and details of current pregnancy (PG),clinical assessment includes pre-induction bishop score, method of induction used Dinoprostone gel (PGE_2), the gel can be used 2 times, maternal vital sign, general condition , cervical status , membrane status and review of medical records with the help of lab investigation which include routine antenatal investigation, specific investigation as indicated (*eg*: glucose tolerance test for GDM, BP monitoring for high BP disorder), fetal outcome(FO) includes APGAR score, birth weight, neonatal complication& NICU admission if required & maternal outcome(MO) includes mode of delivery (MOD), complication during labour and postpartum recovery(PPR).

Inclusion criteria:
[1] Who all were admitted for IOL
[2] Singleton PG.
[3] Gestational age (GA) ≥ 28 weeks.
[4] Cephalic presentation.
[5] Consent provided for participation.

Exclusion criteria:
[1] Multiple GA.
[2] Known fetal anomalies.
[3] Previous uterine surgery (*e.g.*: cesarean section, myomectomy).
[4] Severe medical complications requiring immediate delivery.
[5] Non-cephalic presentation.
[6] Placental abnormalities (*e.g.*: placenta previa).

Table 1: Age distribution

	Failed	Successful

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Age (years)	Induction(FI)		Induction(SI)		P value
	Cases	%	Cases	%	
<20	13	28.30%	4	8.70%	
20–30	30	65.20%	37	80.40%	0.049
31–40	3	6.50%	5	10.90%	
Total	46	100.00%	46	100.00%	

Table 2: Parity distribution

Parity	FI		SI		P value
	Cases	%	Cases	%	
Nullipara (NP)	28	60.90%	18	39.10%	
Multipara(MP)	18	39.10%	28	60.90%	0.037
Total	46	100.00%	46	100.00%	

Table 3: GA distribution

Parity	FI		SI		P value
	Cases	%	Cases	%	
Nullipara(NP)	28	60.90%	18	39.10%	
Multipara(MP)	18	39.10%	28	60.90%	0.037
Total	46	100.00%	46	100.00%	

Table 4: PIBS distribution

Pre-induction bishop score (PIBS)	FI		SI		P value
	Cases	%	Cases	%	
Favorable (FV)	5	10.90%	39	84.80%	
Unfavorable(U-FV)	41	89.10%	7	15.20%	0.03
Total	46	100.00%	46	100.00%	

Table 5: BMI distribution

BMI	FI		SI		P value
	Cases	%	Cases	%	
Normal(N)	6	13.00%	31	67.40%	
Overweight(OW)	26	56.50%	11	23.90%	
Obese (OB)	14	30.40%	4	8.70%	<0.001
Total	46	100.00%	46	100.00%	

Table 6: PIMS distribution

Pre-induction membrane status (PIMS)	FI		SI		P value
	Cases	%	Cases	%	
Intact	40	87.00%	39	84.80%	
Ruptured	6	13.00%	7	15.20%	0.764
Total	46	100.00%	46	100.00%	

Table 7: HYT-D comparison

Hypertensive disorder of pregnancy (HYT-D–PG)	FI		SI		P value
	Cases	%	Cases	%	
Present	18	39.10%	22	47.80%	
Absent	28	60.90%	24	52.20%	0.401
Total	46	100.00%	46	100.00%	

Table 8: GDM distribution

GDM	FI		SI		P value
	Cases	%	Cases	%	
Present	4	8.70%	2	4.30%	
Absent	42	91.30%	44	95.70%	0.398
Total	46	100.00%	46	100.00%	

Table 9: IUFG distribution

Intrauterine fetal growth (IUFG)	FI		SI		P value
	Cases	%	Cases	%	
IUGR	4	8.70%	2	4.30%	
Normal	42	91.30%	44	95.70%	0.398
Total	46	100.00%	46	100.00%	

Table 10: FS distribution

Fetal Survival (FS)	FI		SI		P value
	Cases	%	Cases	%	
Intrauterine Death (IU-D)	1	2.20%	3	6.50%	
Survived	45	97.80%	43	93.50%	0.308
Total	46	100.00%	46	100.00%	

Table 11: OGD distribution

Oligohydramnios (OGD)	Failed Induction		Successful Induction		P value
	Cases	%	Cases	%	
Present	5	10.90%	3	6.50%	
Absent	41	89.10%	43	93.50%	0.459
Total	46	100.00%	46	100.00%	

Statistical analysis:

Data was analyzed using SPSS software. Comparative analysis between group A & B was done using chi-square test for categorical variables and t-test for continuous variables. Multivariate logistic regression was identified using in depend predictors of FI.

Results:

Table 1 shows that, in each group 46 cases were enrolled. Among those aged <20 years, 13 cases (28.3%) resulted in FI compared to 4 cases (8.7%) that were SI. In the 20-30 years age group, 30 cases (65.2%) FI while 37 cases (80.4%) were SI. For individuals aged 31- 40 years, 3 cases (6.5%) FI and 5 cases (10.9%) were SI. P value is less than 0.05 it means that FI is higher in lower age group (<20 years) compare to higher age groups. (P = 0.049). **Table 2** shows that, among NP, 28 cases (60.9%) experienced FI compared to 18 cases (39.1%) that resulted in SI. Conversely, in the MP group, 18 cases (39.1%) had FI while 28 cases (60.9%) were SI. The P value is less than 0.05 it indicating a higher rate of SI among MP compared to NP women. (P = 0.037). **Table 3** shows that, among PG at less than 37 weeks GA, 18 cases (39.1%) resulted in FI compared to 4 cases (8.7%) that were SI. In the 37-40 weeks GA group, 25 cases (54.3%) FI while 38 cases (82.6%) were SI. For PG beyond 40 weeks, 3 cases (6.5%) experienced FI and 4 cases (8.7%) were SI. The P value is less than 0.05 it means that higher rates of SI among age at 37 to 40 weeks compared to other groups. (P = 0.002). **Table 4** shows that, among cases with a FV-BS, 5 (10.9%) experienced FI while 39 (84.8%) were SI. In contrast, among cases with a U-FV-BS, 41 (89.1%) resulted in FI and 7 (15.2%) were SI. The P value is less than 0.05 it indicating higher success rates in cases with a FV-BS and a significant association between U-FV scores and FI. (P = 0.030).

Table 5 shows that, in N-BMI group, 6 cases (13.0%) experienced FI compared to 31 cases (67.4%) that were SI. In the OW group, 26 cases (56.5%) FI while 11 cases (23.9%) were SI. Among the OB group, 14 cases (30.4%) had FI and 4 cases (8.7%) were SI. The P value is less than 0.05 it means that the result is statistically significant. In OW and OB group, the rate of FI is higher compare to N-BMI group. (P = <0.001). **Table 6** shows that, among cases with intact membranes, 40 (87.0%) experienced FI while 39 (84.8%) were SI. Conversely, among

cases with ruptured membranes, 6 (13.0%) had FI and 7 (15.2%) were SI. The P value is more than 0.05 it means the results is statistically not significant (P=0.764). **Table 7** shoes that, among cases where HYT-D of PG was present, 18 (39.1%) experienced FI while 22 (47.8%) were SI. Conversely, among cases where HYT-D of PG was absent, 28 (60.9%) resulted in FI and 24 (52.2%) were SI. The P value is more than 0.05 it means the result is statistically not significant (P=0.401). **Table 8** shows that, among cases where GDM was present, 4 (8.7%) experienced FI while 2 (4.3%) were SI. In contrast, among cases where GDM was absent, 42 (91.3%) resulted in FI and 44 (95.7%) were SI. This result suggests that the presence of GDM does not significantly impact the success of labor induction (LI) (P=0.398).

Table 9 shows that, in cases with IUFG, 4 (8.7%) experienced FI while 2 (4.3%) were SI. Conversely, among cases with normal IUGR, 42 (91.3%) resulted in FI and 44 (95.7%) were SI. Thus, suggests that IUFG status does not significantly impact the success of LI, as indicated by comparable rates of SI in both groups. (P =0.398). **Table 10** shows that among cases where induction failed, 1 (2.2%) resulted in IU-D compared to 3 (6.5%) cases that were SI. In contrast, among cases where induction was successful, 45 (97.8%) resulted in FS while 43 (93.5%) were SI. The result is statistically not significant. (P= 0.308). **Table 11** shows that, among cases where OGD was present, 5 (10.9%) experienced FI while 3 (6.5%) were SI. However, in cases where OGD was absent, 41 (89.1%) resulted in FI and 43 (93.5%) were SI. The P value is >0.05 it indicates that the presence of OGD does not significantly impact the success of labor induction. (P = 0.459).

Discussion:

46 cases were enrolled in each group in the present study. Among those aged less than 20 years, 13 cases (28.3%) resulted in FI compared to 4 cases (8.7%) that were SI. In the 20-30 years age group, 30 cases (65.2%) FI while 37 cases (80.4%) were SI. For individuals aged 31– 40 years, 3 cases (6.5%) FI and 5 cases (10.9%) were SI. P value is less than 0.05 it means that FI is higher in lower age group (<20 years) compare to higher age groups. (P = 0.049) Similar result observed in the study by Tadesse *et al.* **[11]** and Demssie *et al.* **[16].** In the research of Tadesse *et al.* among women aged 30 and younger, 105 (19.3%) had FI, whereas 439 (80.7%) had successful ones. Among women over the age of 30, 69 (40.8%) had unsuccessful induction (US-I), whereas 100 (59.2%) had a successful one. demonstrating a much-increased chance of US-I in this age range. After accounting for possible confounders, the adjusted odds ratio (AOR) remains considerably higher at 3.7 (95% CI: 2.2-6.2), suggesting that advanced maternal age (> 30 years) is independently linked with a greater risk of US-I of labour. P < 0.001 there is a significantly substantial connection between age above 30 years and failure induction of labour **[17].** EA *et al.* found individuals aged <20 years exhibited a notably higher incidence of FI (39.6%) compared to older counterparts (20–34 years, 24.8%; 35–49 years, 20.9%). A significant association was observed with those under 20 years demonstrating increased odds of FI (COR 2.47, 95% CI 1.09-5.57, p < 0.05) relative to the reference group (20–34 years). Conversely, the result was not statistically significant, it means no differences were found in induction outcomes between the 20–34 years and 35–49 years age groups **[16].**

Among NP, 28 cases (60.9%) experienced FI compared to 18 cases (39.1%) that resulted in SI. Conversely, in the MP group, 18 cases (39.1%) had FI while 28 cases (60.9%) were SI. The P value is less than 0.05 it indicating a higher rate of SI among MP compared to NP women. (P = 0.037) Tadesse *et al.* study found that NP women had a higher risk of FIOL than MP women **[11].** In present study, in Normal BMI group, 6 cases (13.0%) experienced FI compared to 31 cases (67.4%) that were SI. In the OW group, 26 cases (56.5%) FI while 11 cases (23.9%) were SI. Among the Obese group, 14 cases (30.4%) had FI and 4 cases (8.7%) were SI. The P value is less than 0.05 it means that the result is statistically significant. In OW and OB group, the rate of FI is higher compare to Normal BMI group. (P = <0.001) Additionally, among cases with intact membranes, 40 (87.0%) experienced FI while 39 (84.8%) were SI. Conversely, among cases with ruptured membranes, 6 (13.0%) had FI and 7 (15.2%) were SI. The P value is more than 0.05 it means the results is statistically not significant. (P=0.764) Moreover, among cases where FI, 1 (2.2%) resulted in IU-D compared to 3 (6.5%) cases that were SI. In contrast, among cases where induction was successful, 45 (97.8%) resulted in FS while 43 (93.5%) were SI. The result is statistically not significant. (P= 0.308) Ejigu *et al.* found women with BMI >24 kg/m² (49 cases) had significantly higher odds of failed induction compared to those with BMI ≤24 kg/m² (43 cases) (AOR 5.71, 95% CI 3.26-10.01, p < .001) **[17].** Ehrenberg *et al.* discovered that intrauterine foetal development status had no significant impact on labour induction outcomes **[18].** Similarly, Tanir *et al.* found that, whereas IUGR is related with various problems, it has no significant effect on labour induction success rate **[19].** Similarly, Grobman *et al.* discovered that, while inducement of labour can raise risks, the overall impact on FS did not differ substantially between unsuccessful and successful induction however **[20].** Zhang *et al.* pointed out those unsuccessful inductions might result in greater rates of caesarean birth, which could have an indirect influence on infant outcomes **[21].**

In the multivariable analysis of factors influencing FI of labor at AHMC, Ethiopia in 2020, the presence of Oligohydramnios did not show a significant association with the likelihood of FI. The data revealed that among PG without OGD, 25.4% experienced FI compared to 26.2% in cases with OGD (AOR 1.0, 95% CI 0.7-1.7). This finding suggests that OGD may not independently impact the success of LI in this cohort. However, further investigation with larger sample sizes or specific clinical contexts may be needed to better understand its potential influence on induction outcomes **[22].** His duration of induction is also a known risk factor. The risk increases linearly during an induction, with more vaginal births happening early on and more caesarean deliveries occurring later **[23].** In Beckmann's

2007 study, the length of the latent period dramatically increased the risk of a C-section delivery **[24].** Certain fetal features may also influence induction success. Higher birth weights have been linked to an increased risk of US-I, including a higher caesarean delivery rate and a lower vaginal delivery rate **[24, 25].**

Conclusion:

Body mass index (BMI) was another key determinant, with normal BMI associated with higher success rates compared to Overweigh (OW) and Obese (OB) categories. Cervical ripening prior to induction was significantly beneficial, markedly improving success rates. Membrane status, Hypertensive disorder (HYT-D), Gestational diabetes mellitus (GDM), Fetal growth restriction (FGR), Intrauterine Death (IU-D) and OGD showed no significant impact on induction success, indicating these factors may not be as influential.

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