Factors Influencing the Outcome of Labor Induction and Nursing Implication

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Abstract: Induction of labor (IOL) refers to the process of artificially initiating uterine contraction, prior to the spontaneous onset of labor with the aim of achieving vaginal delivery. **Aim:** to identify the factors affecting the outcome of IOL and evaluate the effect of educational program on nurse's knowledge about IOL. **Subject & Methods:** a prospective observational study design was used in labor ward at Ain Shams Maternity Hospital and Helwan General Hospital-Egypt. 200 parturient women who received IOL were selected. A structured interviewing schedule, maternal and neonatal assessment sheet, partograph, IOL record were used for data collection. Pre-post assessment questionnaire was used to assess nurse's knowledge about the management of patients with IOL. **Results:** the rate of labor induction in the current study was 15.0 % and 71.0% of women had successful IOL and the rest (29.0%) had failure in induction and underwent CS. The most common indication for the CS was fetal distress (46.5%). Nulliparity, age ≤ 25 years, obesity and bishop score ≤ 5 as well as duration of labor ≤24 hours were mostly exposed to CS. Post intervention there was significant improvement (p=0.001*) in nurse's knowledge about IOL and the protocol of oxytocin and misoprostol administration. **Conclusion:** Nulliparity, age ≤ 25 years, obesity and bishop score ≤ 5 as well as duration of labor ≤24 hours were mostly exposed to CS. Post intervention there was significant improvement (p=0.001*) in nurse's knowledge about IOL. **Recommendations:** Factors associated with failure in IOL should be identified and receive the best possible management. Upgrading nurse's knowledge and practice regarding this important procedure is mandatory.
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1. Introduction

Induction of labor (IOL) is defined as; the artificial termination of pregnancy after the age of viability and before the spontaneous onset of labor for the purpose of accomplishing vaginal delivery. It is indicated when the risk–benefit analysis indicates that delivering the baby is a safer option for the baby, the mother or both rather than continuing the pregnancy and when there are no clear indications for CS and no contraindications for vaginal delivery ***[1]***.

According to the most current studies in IOL, the rate varies from 9.5% to 33.7%. The increasing rate of IOL may be due increasing rates of complications associated with pregnancy such as; gestational diabetes, preeclampsia, availability of cervical ripening agents and pressure from patients ***[2]***. The study in Assiut-Egypt has found that the incidence of IOL was 9.3%. Lowering rate of IOL was due to the decrease of external fetal monitoring devices (EFM), equipment, supplies and shortage of qualified staff ***[3]***.

Induction of labor is indicated when the risk of continuing the pregnancy, for the mother or the fetus, exceeds the risk associated with induced labor and delivery. The indications include; post-date, premature rupture of membrane, preeclampsia, diabetes and intrauterine growth retardation ***[4]***. The potential risks associated with IOL include; cesarean delivery, meconium-stained amniotic fluid and prematurity. In addition to prolonged labor, failed induction, cord prolapse and primary postpartum hemorrhage ***[5]***. **Skidmore (2013)** mentioned several clinical situations that are not generally considered contraindications to IOL but require caution, including breech presentation, grand multiparity, non-reassuring fetal testing, polyhydramnios, multifetal gestation and maternal cardiac disease ***[6]***.

For practical purposes, modern obstetricians use two broad approaches for IOL (pharmacological and non-pharmacological methods) that have proven efficacy for cervical ripening or IOL. The method adapted and used depends on the duration of the pregnancy, the condition of the cervix "favorable or unfavorable" and the position of the fetal head in relation to the pelvis ***[7, 8]***. Pharmacological methods employ pharmacological agents to alter the cervical state, initiate uterine activity or act by a combination of methods. It includes PGE1e.g misoprostol, PGE2 "two forms are available; Prepidil and cervidil", Oxytocin and Relaxin. Prostaglandins are widely used along with oxytocin in developed countries. Oxytocin alone should only be used in nulliparous

women with a single fetus, in the vertex presentation, having spontaneous labor, membrane is ruptured and the amniotic fluid is clear ***[9, 10]***.

The positive maternal and neonatal outcomes of IOL are; regular uterine contractions (every 3 minutes), and cervical dilatation after at least 24 hours of oxytocin administration, achieving spontaneous vaginal birth within a specified time. In addition to decreasing maternal anxiety, early detection of neonatal respiratory distress, meconium staining and fetal hypoxia, decreasing neonatal hospitalization in the NICU and decreasing mortality rate ***[11, 12]***. Failed induction of labor means failure to have regular contractions (every 3 minutes) and failure of the cervix to change after at least 24 hours of oxytocin administration ***[13]***.

Nurses working with women undergoing IOL play an important role in assisting with the assessment, monitoring and management of patient and fetal condition. Close, frequent assessment and follow up interventions are essential to ensure the safety of the mother and the fetus during cervical ripening and induction of labor process ***[14]***. Therefore, upgrading nurse's knowledge and practice using a standardized protocol for the properly selected cases of IOL is mandatory to be safe and convenient than waiting for spontaneous labor because of its predetermined timing. It is hoped that the outcome of this study may engender a change in the present policy of IOL, and suggest ways of improving the present level of care.

Aim of the Study

The aim of this study was to identify the factors affecting the outcome of labor induction and evaluate the effect of educational program on nurse's knowledge about IOL and guidelines for oxytocin and misoprostol administration.

Subjects and Methods:

A prospective observational study design was utilized in this study and a purposive sample of 200 women admitted for IOL in the maternity hospital of Ain Shams University and Helwan General Hospital-Egypt from 1st January 2015 till the end of June 2015 was included. Women were selected randomly during a study period of 6 months depending on the following inclusion criteria: Women who have indications for IOL such as; diabetes mellitus and preeclampsia or fetal problems such as; intrauterine growth retardation and fetal anomalies. Both Primigravida and multigravida, women who had had single fetus with vertex presentation and their gestational age was more than or equal to 37 weeks were all selected. Woman who had previous cesarean section or those who were scheduled for CS in the present pregnancy were excluded from the sample.

Tools of Data Collection:

1. **A structured interviewing schedule** that include personal, obstetrical, and medical history such as; age, parity and body mass index and chronic diseases associated with pregnancy
2. **Maternal assessment record** which include the finding of; **General examination on admission to labor room**: such as height, weight to calculate body mass index and maternal vital signs. **Abdominal examination** to determine fetal heart rate and to assess the frequency, duration and intensity of uterine contractions. **Local examinations: (**P.V examination): to determine the cervical dilation, effacement, and station. **Ultrasonography**: to assess the gestational age, fetal viability, and fetal weight.
3. **Partograph**: This was used to evaluate fetal and maternal condition as well as the labor progress during the active phase of the first stage of labor.
4. **Record used for IOL;** it entails data about indications, methods, and the outcome of labor whether it ends with success or failure of induction as well as the maternal and neonatal condition

Concerning the educational program all maternity nurses (20 nurses), working in the previously mentioned settings were selected. **Nurses ' knowledge questionnaire** was developed by **14** and modified by the researcher. It was designed for pre-post assessment to assess nurse's knowledge and practice about the management of patients with IOL as well as the standardized guideline used for the administration of oxytocin and misoprostol.

Official permission was obtained by submission of an official letter from the Faculty of Nursing to the responsible authorities of the study setting to obtain the permission for data collection. All ethical issues were taken into consideration during all the phases of the study; the researcher maintained an anonymity and confidentiality of the subjects. She introduced herself to the women and briefly explained the nature and aim of the study to every woman before participation and women were enrolled voluntarily after the oral informed consent.

As for the preparatory phase, related literature was reviewed. This helped in the selection and preparation of the data collection tools and in writing the review of literature. A panel of two experts in the field of Obstetrics and Gynecological Nursing reviewed the tool to test its content validity. Modifications were done accordingly based on their judgment. Cronbach's alpha coefficient was calculated to assess the reliability of the developed tool through their internal consistency.

The pilot study was carried out on 10% of the sample in the study setting that were excluded from

the study sample, to test the applicability and clarify the feasibility of the study tools and to estimate the time needed to complete the tools. It also helped to find out any obstacles and problems that might interfere with data collection, based on findings of the pilot study, certain modification of the tools were done. Following this pilot study, the process of data collection was performed.

Statistical analysis

An IBM compatible personal computer was used to store and analyze data and to produce graphic presentation for some important results statistical package for the social science (SPSS) version 20 was used for statistic analysis of data as it contains the test of significant given in standard statistic books.

3. Results

The present result revealed that the total number of deliveries within the study period was 1950 in Ain Shams University hospital and 522 in Helwan General hospital, of those the rate of induction was 310 (15.9%) and 62 (11.9%) respectively. In total the rate of IOL in the current study was 15.0%.

Table 1 shows that almost two fifths (40.8%) of women who received combined method of (PGE1, ARM and syntocinon) were significantly more likely to have successful labor induction than failed one (40.8% vs. 7.1% respectively). While, nearly half (48.6%) of women who underwent CS only received PGE1 compared to those delivered by vaginal route (15.4%). Differences observed were statistically significant (p=0.000*).

Table 1: Methods of IOL among the studied sample (n=200)

Methods of labor induction	Outcomes of induction of labor				MCP
	Successful (n=130)		Failure (n=70)		
	No.	%	No.	%	
PGE1+ARM+Sytocinon	53	40.8	5	7.1	0.000*
PGE1 (Misoprostol)	20	15.4	34	48.6	
Sweeping of membranes +ARM+ Syntocinon	30	23.1	19	27.1	
PGE2 (dinoprostone)	12	9.2	9	12.9	
ARM+ Syntocinon	8	6.2	1	1.4	
Sytocinon	7	5.3	2	2.9	

MCP: P value based on Mont Carlo exact probability
* P < 0.05 (significant)

It is obvious from figure 1 that almost three quarters (71.0%) of women had successful induction of labor and the rest (29.0%) had failure in induction and underwent CS.

Table 2 shows that the most common indication for the CS was fetal distress (46.5%) followed by non-engagement of the fetal head (24.2%) and failure of labor progress (13.7%). Almost one tenth (12.1%) were exposed to failure in IOL because of the method used and 3.5% had labor dystocia.

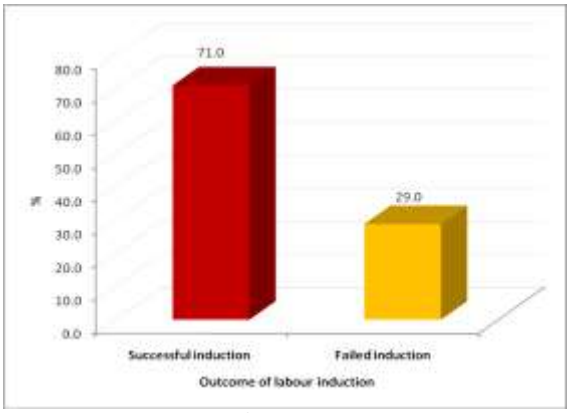

Figure (1): Distribution of Studied Women According to the Outcome of Labor Induction (n=200)

Table 2: Distribution of the Studied Women According to the Causes of Failure in IOL (n=58).

Indications for the cesarean section	No	%
Fetal distress	27	46.5
Non engagement of fetal head	14	24.2
Failure of labor progress	8	13.7
Using prostaglandin only for labor induction	7	12.1
Labor dystocia	2	3.5

Table 3 demonstrates that women in the two groups had partially the same gestational weeks (≥42 weeks, post-term pregnancy) as the most common indication of induction (42.2% and 41.4% respectively). This was partially followed by PROM and PIH. On the other hand, women who had PROM & postdate as well as IUGR were more likely to end with successful labor induction (9.15%, 4.1% vs. 5.2%, 3.5% respectively). Differences observed were not statistically significant.

Table 3: Indications for Labor Induction among the studied sample (n=200)

Indication for Labor induction	Outcome of induction				*FEP*
	Successful (n=142)		Failure (n=58)		
	No	%	No	%	
Post-term pregnancy(≥42 weeks)	60	42.2	24	41.4	0.524
PROM	48	33.8	20	34.5	0.685
Pregnancy induce hypertension	6	4.3	4	6.8	0.715
PIH & PROM	8	5.63	5	8.6	0.607
PROM & Postdated	13	9.15	3	5.2	0.217
IUGR	7	4.9	2	3.5	0.665

FEP: P value based on Fisher exact probability *P < 0.05 (significant)*

Table 4 reveals that, women aged less than 25 years were significantly more vulnerable to failure of IOL (CS) than the older group (56.9% vs.18.9 % respectively). Also, nulliparous women had a statistically higher rate of CS delivery (44.8%) in comparison with multiparous women (24.1%). Meanwhile, over weight and obese women were less likely to have successful IOL compared to those who had normal weight (75.9%, 18.9% vs. 71.8%, 16.9% respectively). Differences observed are statistically significant (p=0.001*)

It is clear in table 5 that Bishop is significantly associated with the outcome of labor induction, Thus women who had a score of <5 were significantly more likely to have failure in IOL. Moreover, women who had successful induction (66.2% vs. 10.3%) were more likely to take a lesser period between induction and beginning of labor (<12). The differences observed are statistically significant (p=0.001*).

Table 6 shows that the vast majority of the studied nurses knew nothing about the methods of IOL, complications and recommendation for induction before the intervention program. This was greatly reduced to at the posttest with statistical significant difference (P=<0.001).

Table 7 shows that almost the entire studied sample had unsatisfactory knowledge about the action, dose, indications, and complications of both oxytocin and misoprostol. Again the difference observed is statistically significant (p<0.001).

Table 4: Basic characteristics of Women in the studied sample (n=2٠٠)

Characteristics	Outcome of induction				*MCP*
	Successful (n=142)		Failure (n=58)		
	No	%	No	%	
Age (years)					
17-24	29	20.5	33	56.9	0.027*
25-29	68	47.8	14	24.2	
30-35	45	31.7	11	18.96	
Parity					
Nullipara	33	23.23	26	44.82	
Primipara	68	47.88	18	31.03	0.048*
2-3	34	23.94	11	18.96	
+٤	7	4.92	3	5.17	
BMI					
Normal	16	11.3	3	5.2	0.418
Overweight	102	71.83	44	75.86	
Obese	24	16.90	11	18.96	

MCP: P value based on Mont Carlo exact probability
* P < 0.05 (significant)

Table 5: Bishop Score and the Period between Induction, Beginning of the Start of Labor among Women in the studied sample (n=200)

Items	Outcome of induction				MCP
	Successful (n=142)		Failure (n=58)		
	No	%	No	%	
Bishop score					
>5	91	64.0	14	24.1	
<5	51	35.9	44	75.9	0.027*
Period between induction and beginning of labor:					
< 12 hrs	94	66.19	6	10.34	
12 - 24 hrs	40	28.16	48	82.75	
> 24 hrs	8	5.63	4	6.89	0.002*

MCP: P value based on Mont Carlo exact probability ** P < 0.05 (significant)*

Table 6: Distribution of nurses knowledge about induction of labor throughout the program phases (n= 20).

Parameters	Knowledge				P*
	Before		After		
	No	(%)	No	(%)	
induction of labor:					
Methods of induction:					
Wrong and incomplete answer	18	90.0	9	45.0	0.008(S)
Complete answer	2	10.0	11	55.0	
Indications of induction:					
Wrong and incomplete answer	13	65.0	6	30.0	0.002(S)
Complete answer	7	35.0	14	70.0	
Complications of induction:					
Wrong and incomplete answer	17	85.0	3	15.0	0.0001(S)
Complete answer	3	15.0	17	85.0	
Recommendations for induction:					
Wrong and incomplete answer	15	75.0	4	20.0	0.005(S)
Complete answer	5	25.0	16	80.0	

*Marginal Homogeneity Test

Table 7: Distribution of nurses knowledge about guidelines in using oxytocin and misoprostol for labor induction throughout the program phases (n= 20)

Parameters	Knowledge				P*
	Before		After		
	No	(%)	No	%	
Oxytocin					
Dosage and the route of administration:					0.0003(S)
Wrong and incomplete answer	19	95.0	6	30.0	
Complete answer	1	5.0	14	70.0	
Indications and contraindications:					
Wrong and incomplete answer	17	85.0	3	15.0	0.009(S)
Complete answer	3	15.0	17	85.0	
Care during administration &Complications :					
Wrong and incomplete answer	16	80.0	6	30.0	0.02(S)
Complete answer	4	20.0	14	70.0	
Misoprostol					
Dosage and route of administration: :					0.0001(S)
Wrong and incomplete answer	20	100	8	40.0	
Complete answer	0	0.0	12	60.0	
Indications and contraindications:					
Wrong and incomplete answer	20	100	8	40.0	0.0001(S)
Complete answer	0	0.0	12	60.0	
Care during administration &Complications					
Wrong and incomplete answer	15	75.0	2	10.0	0.006(S)
Complete answer	5	25.0	18	90.0	

*Marginal Homogeneity Test

4. Discussion

Induction of labor with the goal of achieving vaginal delivery prior to spontaneous onset of labor is recommended when the benefits of delivery out-weight the risk of continuing the pregnancy ***[15]***. The aim of this study was to identify the factors affecting the outcome of labor induction and evaluate the effect of educational program on nurse's knowledge about labor induction and guidelines for oxytocin and misoprostol administration.

The present study finding indicates that the rate of IOL during the study period was 15.0%. This proportion is lower than that reported in the more developed countries ***[16, 17, and 18]*** Australia (29.1%), England (32.3%) and USA (40.0%). On the other hand ***Abdel-Aleem, (2011*)** study in Assiut University Hospital-Egypt, found that out of 1500 deliveries per year the rate of IOL was 9.3% ***[19].*** Moreover, ***Abd El-Kader (2013*)** study in Zagazig-Egypt, found that the incidence of labor induction was 11.7% among the studied sample ***[20].***

Moreover, the present study showed that, out of 200 women undergone IOL, 71.0% women had successful induction. The result of the current study was much lower than the finding reported in Aga Khan Hospital, Pakistan ***[21]***, and King Khalid University Hospital ***(22)*** who reported that the incidence of successful induction (NVD) was 81.9% and 84.0% respectively. But it was higher than that reported by the study done in Addis Ababa Army Referral Hospital ***[23]*** and in Kathmandu Medical College Teaching Hospital, Nepal ***[24]*** (59.7% 58.33% respectively). The discrepancy between the current study finding and the above mentioned studies might be due to the difference in hospital facilities, methods used for IOL and setup to the relief of pain associated with the initiation of uterine contraction.

According to the present study finding, medical and surgical methods (PGE1, ARM and syntocinon) when used in combination gave the best results in terms of both induction-delivery interval and successful vaginal delivery as compared to when either of these methods was used individually. This is in agreement with ***Kaur et al., (2013)*** who found that the combination of induction methods leads to vaginal delivery and decrease the incidence of CS ***[25].***

The current study finding revealed that nulliparity was significantly more likely to be associated with failure of IOL. In ***Khan et al.,*** study ***[26]*** 18% of their pregnant population who underwent IOL because of either indication or elective indications failed to deliver vaginally. They found that the IOL (at term) in nulliparous women is a significant risk factor for emergency CS. Failed induction was 4.6 times more likely in nulliparous patients compared to their multiparous counterpart. Also, ***Rouse et al., [27]*** and ***Bodner-Adler et al., [28]*** found that primiparity is significantly reducing the probability of successful induction compared with multiparty.

The present study finding revealed that younger women (≤25) years were significantly more liable for failed induction (CS) than the older women. In

disagreement with this ***Walker et al., [29]*** found that, women over 35 years were at higher risk for failure in IOL. This could be explained by the fact that the advanced maternal age put the women at great risk of hypertensive disorders, gestational diabetes, placenta Previa and abruption placental. Also, women themselves may ask for elective IOL because they believe that their age puts their newborn at increased risk.

Moreover, obese and morbidly obese women were more vulnerable to have failure in IOL. This correspond well with the finding of ***[30]*** about maternal obesity and labor complications following IOL in prolonged pregnancy who found that IOL for obese women is associated with increased rates of CS. A possible explanation was the association of obesity with the increasing risk of gestational diabetes, gestational hypertension, macrosomia, shoulder dystocia and poor myometrial contractility ***[31].***

In the current study the common indications for IOL were post term pregnancy and PROM, this is in congruence with ***Mackenzie [32]*** who reported that post term pregnancy and maternal hypertensive disorders are the major indications in the last 50-60 years. Induction of labor in this circumstance is justified to reduce perinatal mortality which increased after 41 weeks of gestation due to deterioration in the function of an ageing placenta. Previous studies ***[33, 34]*** have shown that preterm pregnancies are induced mainly due to PROM, IUGR, and hypertensive disorders, and this is matching with the present result. In these cases CS is usually conducted due to presumed fetal distress or non-progress of labor.

The current study has also shown that the decrease of Bishop (<5) is significantly associated with failure of IOL. This is matching with ***[35]*** where the odds of failed induction were 1.9 times more likely in women with Bishop Score of <5. The condition of the cervix at the start of induction is an important predictor, with the modified Bishop score being a widely used scoring system. Induction of labor results in high failure rate if the cervix is not ripe. Similar results were noted in the present study with decrease in the rate of failed IOL with increase in bishop scores. Duration of IOL is also a known risk factor. The risk increases over the course of an induction, with more NVD occurring early in induction and more CS occurring later ***[36].*** This coincides with the finding of the present study where failure in IOL was statistically associated with longer duration between induction and the beginning of labor.

An important implication of the present study finding was to explore the role of the maternity nurse in IOL. Therefore, the ultimate goal of the present educational program is to upgrade nurses' knowledge about IOL and guidelines for oxytocin and misoprostol administration. In line with this, it has been shown that increased awareness of nurses about IOL depends on their perception of the importance of the procedure as the best option of treatment to protect parturient health and saves their newborn life ***[37].***

According to the assessment of the baseline knowledge pertaining to IOL, the guideline used for oxytocin and misoprostol administration, the present study finding revealed that the mean scores regarding; definition, indications, contraindications and complications before the program implementation were generally deficient. The implementation of the present study intervention led to significant improvements among nurses regarding the studied parameters of this problem. The foregoing findings confirm the positive effect of the educational program in improving nurse's knowledge about IOL. This may be attributed to the fact that the researcher used simple applications and simulations in order to simplify the information and help nurses to apply their knowledge to practice.

The above mention findings are in agreement with ***[38]*** who found that the level of nurses knowledge on IOL is limited, which could be an obstacle to monitoring of patients receiving oxytocin and misoprostol and thus could lead to the failure in labor induction In this respect ***[39]*** emphasized the importance of upgrading nurse's knowledge about this important procedure and let them compiled with the usage of the conservative checklist based protocol to govern their behavior in high-risk situations, and crew resource management. Its usage leads to improved perinatal outcomes, and reduced primary cesarean delivery rate, lower maternal and fetal injury and improvement in practice quality.

Conclusion

More than one fourth of patients had failure in labor induction and were exposed to CS. The common indications for IOL were; post term pregnancy, PROM, premature rupture of membrane plus post term pregnancy and PIH. Methods used for induction when used in combination gave the best results in terms of both induction-delivery interval and successful vaginal delivery as compared to when either of these methods was used individually. Nulliparity, age ≤ 25 years, obesity and bishop score ≤ 5 as well as duration of labor ≤24 hours were mostly exposed to CS. Post intervention there was significant improvement in nurse's knowledge about IOL and the protocol of oxytocin and misoprostol administration.

Recommendations

Woman undergoing IOL should be closely monitored by the nurse midwife. Factors associated with failure in labor induction should be identified and receive the best possible management. Upgrading nurse's knowledge regarding this important procedure is mandatory and the written clinical guidelines for management of the women undergoing labor induction should be present in the labor and delivery unit. Further researches are recommended.

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