Outcomes of Induction of Labor at a Cottage Hospital in the Nigerian Niger Delta Region

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ABSTRACT

INTRODUCTION: Induction of labor (IOL) remains one of the commonly performed obstetric interventions worldwide when its benefits outweigh the risks. Several factors have been shown to be associated with successful outcome of IOL (achieving vaginal delivery). This study evaluated the outcomes of IOL and the determinants of successful outcome in Obio Cottage Hospital (OCH), Port-Harcourt.

METHODS: It was a retrospective analysis of all pregnant women who had IOL in the Maternity unit of OCH between 1st January 2023 and 31st December, 2023. Data were analyzed using SPSS and logistic regression done for determinants of successful IOL.

RESULTS: The prevalence of IOL was 17.2% of all deliveries while 87.5% of the parturient had vaginal delivery. Postdatism and dystocia were the commonest indication for IOL and caesarean section after failed IOL respectively. Estimated fetal weight of 2.5-3.9kg [AOR = 3.41, 95% CI (1.09-5.32)], cervical ripening with combined Foley's catheter and misoprostol [AOR = 3.76, 95% CI (1.23-7.36)] and misoprostol only [AOR = 1.68, 95% CI (1.12-5.72)]; and birth weight of 2.5-3.9kg [AOR = 4.35; 95% CI (1.82-6.01)] were the determinants of vaginal delivery among the parturient.

CONCLUSION: In carefully selected parturient and with the use of appropriate method of cervical ripening, IOL is safe with high successful vaginal delivery rate and good maternal and perinatal outcomes.

Keywords: Outcomes, Induction of labour, Determinants, Cottage hospital, Niger Delta Region

INTRODUCTION

Induction of labor (IOL) is a commonly performed procedure in obstetric practice worldwide and it is done when the risk of continuing intrauterine fetal life far outweighs extrauterine fetal life [1]. Induction of labor is defined as the artificial stimulation of uterine contractions before the onset of labor naturally with the aim of achieving vaginal delivery [2]. Labor induction is done when the benefits outweigh the risk [3].

The prevalence rate of induction of labor varies across countries globally but higher in the High-Income Countries (HICs) compared to the Low- and Middle-Income Countries (LMICs) and this IOL rate has continued to be on the rise [4,5]. According to World Health Organization (WHO) Global survey on Maternal and Perinatal Health, which included 373

healthcare facilities in 24 countries and nearly 300, 000 deliveries, 9.6% of the deliveries were labor induction [1]. The induction rate was the lowest in Niger (1.4%) and the highest in Sri Lanka (35.5%) [1]. In Nigeria, Okunola et al. [6] and Lawani et al. [7] reported induction rate of 10.9% and 11.5% respectively.

The indications for IOL could be maternal indication which include medical conditions like diabetes mellitus, hypertensive disorders of pregnancy, renal disease and sickle cell anemia or fetal indications which include intrauterine growth restriction, rhesus iso-immunization, fetal congenital anomalies and intrauterine fetal death. Other indications include postdate pregnancies and prelabor rupture of fetal membrane [3,4,6]. A variety of pharmacological and non-pharmacological methods are used for IOL. Pharmacological methods include oxytocin, prostaglandin (PG) analogues and smooth muscle stimulants such as herbs or castor oil, whereas non-pharmacological methods include mechanical methods such as digital stretching, hygroscopic cervical dilators, balloon catheters, artificial rupture of the membranes and nipple stimulation [8].

Even though there are well documented indications for IOL, various complications have also been recorded for this procedure. These complications include uterine hyperstimulation, genital tract lacerations, uterine rupture, postpartum hemorrhage, fetal distress, and intrapartum fetal death [9]. Several factors have been shown to be associated with successful outcome of IOL (achieving vaginal delivery). These factors include methods of induction of labor and cervical ripening either by surgical methods (artificial rapture of the membrane, balloon catheter) or pharmacological methods (oxytocin, misoprostol). Also, factors like maternal age, gestational age of a pregnancy, multiparity, birth weight of less than 3500gm and favorable cervical status increase the likelihood of success rate of induction of labor [3,10,11].

The success of IOL and the associated factors may vary from one health institution to the other. It is therefore important to constantly evaluate the procedure of induction of labor in various institutions. To the best of our knowledge, there has no previous IOL audit in our centre. This study was done to evaluate the outcomes of induction of labor and determinants of successful induction which can be used to improve patients' management.

METHODS

Study design and setting: This was a retrospective study of all pregnant women who had induction of labor in the Maternity unit of Obio Cottage Hospital, Port-Harcourt in Nigerian Niger Delta region between 1st January 2023 and 31st December, 2023. Obio Cottage Hospital is a primary health centre upgraded by The Shell Petroleum Development Company of Nigeria Limited and its Joint Venture partners (SPDC-JV) to provide affordable and accessible maternal and child health care. This is achieved through its Community Health Insurance Scheme (CHIS), a public, private partnership (PPP) involving the SPDC-JV partners, Rivers State Government and the community. The monthly antenatal booking and antenatal clinic visits average at 400 and 2500 respectively with a delivery rate of about 260 babies every month.

Study population: Pregnant women scheduled for induction of labor were usually assessed for cervical ripening using the bishop score and the cervix is considered 'ripe' or favorable when the bishop score is at least 6 with highest score being 13. Cervical ripening was done for those with unfavorable cervix using transcervical extra-amniotic Foley's catheter (Agary Catheters, Yangzhou, Jiangsu, China) and passage of vaginal misoprostol (CytotecR Pfizer, Division of Pfizer Inc, NY, USA) either used singly or combined together. After ripening, some parturient progressed into spontaneous labor while some had amniotomy, oxytocin titration or both for induction of labor.

Data collection: All pregnant women with singleton cephalic pregnancy with reactive cardiotocography, good fetal biophysical profile, no previous caesarean section and had induction of labor for one indication or the other at term (gestational age of 37 completed weeks and above) were included in the study while those who did not meet the above criteria including women who had one or more caesarean delivery and with incomplete medical records were excluded. The case files of the women who underwent labor induction were retrieved from the Medical Record Department and data were extracted using a study proforma. Data retrieved include their demographic variables like age, parity, occupation, ethnicity, marital status, booking status, gestational age at induction and indication for induction;

method and agent of induction, dose and no of misoprostol passed, induction-delivery interval, induction outcome, method of delivery and fetal outcome such as birth weight, Apgar scores at

Table 1: Sociodemographic characteristics of women with induction of labour

Variables	Frequency (N=570)	Percentages (%)
Age (years)		
≤ 19	4	0.7
20-24	48	8.4
25-29	190	33.3
30-34	226	39.6
≥ 35	102	17.9
Mean ± SD	30.3 ± 4.3	
Parity		
0	256	44.9
1	154	27.0
2-4	117	20.5
≥ 5	43	7.5
Median	1	
Education		
No formal education	2	0.4
Primary	15	2.6
Secondary	164	28.8
Tertiary	389	68.2
Occupation		
Unemployed	62	10.9
Self-employed	244	42.8
Private employed	61	10.7
Government employed	203	35.6
Gestational age at induction (weeks)		
< 37	22	3.9
37-39.6	156	27.4
≥ 40	392	68.8
Median (weeks)	40.3	
Indication for induction		
Postdatism	406	71.2
Hypertensive disorders of pregnancy	126	22.1
Gestational diabetics mellitus	18	3.2
Prelabour rupture of membranes	8	1.4
Others (iufd, oligohydramnios etc)	12	2.1
Maternal complications		
None	531	93.1
Perineal lacerations	29	5.1
Uterine hyperstimulation	6	1.1
Retained placenta	4	0.7

1 and 5 minutes, admission and indication for admission into neonatal intensive care unit. The primary outcome was vaginal delivery among the parturient.

Data analysis: Data collected were analyzed using IBM SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, N.Y., USA). Categorical variables were presented in frequency and percentages while continuous variables were expressed in mean and standard deviation. Chi square was used in testing for significance for categorical variables and

Table 2: Outcomes of labour induction

Variables	Frequency (N=570)	Percentages (%)
Agent of cervical ripening		
Foley's catheter	5	0.9
Misoprostol	90	15.8
Foley's catheter and misoprostol	475	83.3
Dose of misoprostol (n=565)		
25mcg	286	50.6
50mcg	279	49.4
No of times misoprostol passed (n=565)		
1	427	75.6
2	101	17.9
3	37	6.5
Method of induction of labour		
Amniotomy	281	49.3
Oxytocin	9	1.6
Amniotomy + oxytocin	280	49.1
Induction delivery interval (hours)		
≤ 12	368	64.5
> 12	202	36.5
Median (hours)	10.11 ± 4.42	
Outcome of induction		
Successful	499	87.5
Failed	71	12.5
Method of delivery		
Spontaneous vaginal delivery	484	84.9
Instrumental vaginal delivery	15	2.6
Caesarean section	71	12.5
Indication for caesarean section (n=71)		
Dystocia	53	74.6
Fetal distress	9	12.7
Patient request	6	8.5
Abruptio placentae	3	4.2
Fetal outcome		
Alive	562	98.6
Fresh still birth	2	0.4
Macerated still birth	6	1.1

student t test for continuous variables. Significant bivariate variables were into logistic regression model for determinants of successful vaginal delivery among the parturient using adjusted odd ratio and 95% confidence interval and p value < 0.05 was considered statistically significant.

The study was approved by the Institution's Ethics and Research Committee (EKSUTH/A45/2023/06/006. The information extracted from the case files were treated with confidentiality and anonymity.

RESULTS

There were 3375 deliveries during the 12-month study period and 581 parturient had induction of labor (IOL). However, 11 case files of parturient who had IOL were excluded from the analysis due to incomplete records. The prevalence rate of induction of labor was 17.2% and the rate of successful induction among the parturient in this study was 87.5%

The mean age of the women was 30.3 ± 4.3 years with majority (72.9%) between 25 and 34years. About 44.9% of the women were nulliparous with a median parity of 1 while about two-thirds (68.8%) had IOL above 40 weeks gestational age and the median gestational age at induction was 40weeks + 3 days. All the women were married and had antenatal care in the facility with about four-fifths (79.1%) in one form of employment or the other. Postdatism was the commonest indication for induction of labor in this study accounting for 71.2%. Other sociodemographic characteristics are as shown in Table 1.

Table 2 showed that about four-fifths (83.3%) of the parturient had combined Foley's catheter and misoprostol for cervical ripening before IOL, 75.6% of them had a single dose of misoprostol passed into the posterior vaginal fornix and about half (49.3%) of them had onset of spontaneous labor after cervical ripening with 50.7% requiring oxytocin augmentation. About two-thirds (64.5%) of the parturient delivered within 12 hours of commencement of induction with a mean induction delivery interval of 10.11 ± 4.24 hours. Dystocia was the commonest indication for caesarean section accounting for 74.6% of cases.

Table 3 showed that on bivariate analysis, the estimated fetal weight, agent of cervical ripening, the dose of misoprostol passed into the posterior fornix, methods of induction of labor and birth weight of the baby were significantly associated with vaginal delivery among the parturient, p < 0.05 while age of the parturient, gestational age at induction, induction delivery interval and Apgar score at 5 minutes were not statistically significant, p > 0.05.

However, the regression analysis of the significant factors from the bivariate analysis revealed that estimated fetal weight of 2.5-3.9kg [AOR = 3.41, 95% CI (1.09-5.32)], cervical ripening with combined Foley's catheter and misoprostol [AOR = 3.76, 95% CI (1.23-7.36)] and misoprostol only [AOR = 1.68, 95% CI (1.12-5.72)]; and birth weight of 2.5-3.9kg [AOR = 4.35; 95% CI (1.82-6.01)] were the determinants of successful vaginal delivery following IOL, p < 0.05 as shown in Table 4.

DISCUSSION

Induction of labor remains one of the commonly performed obstetric procedures worldwide with its associated maternal and fetal outcomes. Our study showed that the prevalence rate of induction of labor in our facility was 17.2%. This rate is similar to the finding reported by Abisowo et al. from a Nigerian tertiary maternity unit [10] but higher than figures reported by Okunola et al. [6] and Lawani et al. [7] but lower than figures from studies done by Yosef et al. [4] and Abdulkadir et al. [12]. The differences in the rate of IOL from the various studies might be a reflection of the different policy and protocol of induction including the methods of cervical ripening used before IOL in the various centres. Our centre is more or less like a secondary health facility where high risk pregnancies are managed and this might contribute significantly to the high induction rate as opined by Okunola et al. [6] and Bukola et al. [13].

The rate of successful IOL was 87.5% and that of failed IOL was 12.5%. The successful induction rate was higher than the figures reported in previous studies by Lawani et al. (73.6 %) [7], Abisowo et al. (75.9%) [10] and Luton et al. (76%) [14] but lower than 91% reported by Ekele et al. [15]. The variation in these figures might be due to the different methods of cervical ripening and IOL employed in the different health institutions. The finding in this study where combined Foley's catheter and misoprostol was used as method of cervical ripening and combined amniotomy and oxytocin for induction of labor in more than four-fifths of

Table 3: Factors associated with successful induction of labour in Obio Cottage Hospital

Variables	Vaginal delivery n=499 (%)	Caesarean delivery n=71 (%)	p value
Age (years)			
≤ 19	4 (100)	0	0.484
20-24	45 (93.8)	3 (6.3)	
25-29	163 (85.8)	27 (14.2)	
30-34	200 (88.5)	26 (11.5)	
≥ 35	87 (85.3)	15 (14.7)	
Gestational age at induction (weeks)			
< 37	19 (86.4)	3 (13.6)	0.784
37-39.6	139 (89.1)	17 (10.9)	
≥ 40	341 (87.0)	51 (13.0)	
Estimated fetal weight (kg)			
< 2.5	26 (78.8)	7 (21.2)	0.000
2.5-3.4	250 (94.3)	15 (5.7)	
3.5-3.9	203 (91.0)	20 (9.0)	
≥ 4	20 (40.8)	29 (59.2)	
Agent of cervical ripening			
Foley's catheter	3 (60.0)	2 (40.0)	0.038
Misoprostol	74 (82.2)	16 (17.8)	
Foley's catheter and misoprostol	422 (88.8)	53 (11.2)	
Dose of misoprostol used (n=565)			
25mcg	239 (83.6)	47 (16.4)	0.011
50mcg	256 (91.8)	23 (8.2)	
Method of induction of labour			
Amniotomy	240 (85.4)	41 (14.6)	0.033
Oxytocin	6 (66.7)	3 (33.3)	
Amniotomy + oxytocin	253 (90.4)	27 (9.6)	
Induction delivery interval (hours)			
≤ 12	327 (88.9)	41 (11.1)	0.233
> 12	172 (85.1)	30 (14.9)	
Birth weight (kg)			
< 2.5	18 (90.0)	2 (10.0)	0.000
2.5-3.4	278 (94.2)	17 (5.8)	
3.5-3.9	194 (89.4)	23 (10.6)	
≥ 4	9 (23.7)	29 (76.3)	
Apgar score @ 1 minute			
< 7	15 (65.2)	8 (34.8)	0.001
≥ 7	484 (88.5)	63 (11.5)	
Apgar score @ 5 minutes			
< 7	8 (72.7)	3 (27.3)	0.133
≥ 7	491 (87.8)	68 (12.2)	
Admission to NICU			
Yes	12 (63.2)	7 (36.8)	0.001
No	487 (88.4)	64 (11.6)	

the parturient showed that IOL is 4 times more likely to result in vaginal delivery with combined catheter and misoprostol [AOR = 3.76, 95% CI (1.23-7.36)] with resultant vaginal delivery in almost 90% of cases. This corroborated the report of previous studies on the efficacy of this method of cervical ripening in IOL [16,17]. However, while misoprostol was the preferred method of cervical ripening and IOL in some previous studies [6,7,18], the success rate recorded with the use of misoprostol alone in our centre [AOR = 1.68, 95% CI (1.12-5.72)] was similar to the findings of these studies but lower than the success rate with the combined method. We therefore opine that combined method of cervical ripening should be adopted as the preferred method of cervical ripening in IOL.

Apart from the methods of cervical ripening being a determinant of vaginal delivery following IOL in this study, the odd of successful vaginal delivery was tripled when the estimated fetal weight before IOL was between 2.5kg and 3.9kg [AOR = 3.41, 95% CI (1.09-5.32)] as opposed to less than 2.5kg or 4kg and above. This was consistent with findings from Ile-Ife by Okunola et al. [6]. The mean birthweight in our study was 3.40 ± 0.47 kg and the odd of achieving vaginal delivery were four times more in parturient with birth weight of 2.5kg to 3.9kg [AOR = 4.35; 95% CI (1.82-6.01)] than those with birth weight above 4kg. This is consistent with report in a study by Lawani et al. [7] where most babies had average weight between 2.5-3.9kg and opined that macrosomia was not a major concern for failed induction even though other studies had documented that macrosomia is a known predictor of failed induction [19,20]

The commonest indication for cervical ripening in our study was postdated pregnancy and this is similarly reported in other studies [6,7,16] but in contrast to Yosef et al. [4] and Lueth et al. [14]

Table 4: Determinants of successful induction of labour in Obio Cottage Hospital

Variables	Vaginal delivery AOR (95% CI)	p value
Estimated fetal weight (kg)		
< 2.5	1.02 (0.83-1.76)	0.058
2.5-3.9	3.41 (1.09-5.32)	0.021
≥ 4	1	
Methods of cervical ripening		
Foley's catheter	1	
Misoprostol	1.68 (1.12-5.72)	0.024
Combined	3.76 (1.23-7.36)	0.010
Method of induction		
Amniotomy	1	
Oxytocin	0.11 (0.03-1.95)	0.320
Both	0.32 (0.11-1.98)	0.280
Birth weight (kg)		
< 2.5	2.15 (1.02-4.12)	0.390
2.5-3.9	4.35 (1.82-6.01)	0.002
≥ 4	1	
Apgar score at 1 minute		
< 7	0.93 (0.32-1.24)	0.550
≥ 7	1	
NICU admission		
Yes	1.02 (0.52-1.83)	0.250
No	1	

AOR: Adjusted Odd Ratio, CI: Confidence Interval

where hypertensive disorders of pregnancy and pre-labor rupture of membranes were identified as the most common indication respectively. The median gestational age at IOL was 40weeks and 3 days with about 70% of the parturient above 40 weeks gestational age. This is because parturient who had not fallen into spontaneous labor were scheduled for elective IOL from 40weeks + 0day to 40weeks + 6days following the conclusion from a systematic review and metanalysis of randomized controlled trials on IOL at full term (39 weeks to 40 weeks and 6 days) in uncomplicated singleton gestations that elective induction of labor was associated with maternal and fetal benefits compared with expectant management [21]. The high success rate in this study further strengthens this conclusion.

The mean induction-delivery interval of 10.11 ± 4.24hours reported in this study was comparable to the induction interval reported by Okunola et al. [6], Owolabi et al. [7] and Lawani et al. [22] in their studies. The good perinatal outcome of most babies delivered as reflected by their first and the fifth minute Apgar scores were comparable with findings of other studies which reported good Apgar scores [6,23]. The maternal complications also recorded were not different from the well documented complications following IOL and even spontaneous labor [8,22]. The CS rate of 12.5% following IOL recorded was lower than figures in previous studies and this might be because of the high success rate with the use of the combined method of cervical ripening. The indications for CS which included dystocia, fetal distress and abruptio placentae were not different from those reported in previous studies as reasons for failed induction [4,7,8]. These maternal and perinatal outcomes were consistent with the opinion of who advocated elective induction for uncomplicated singleton gestations once they reach full term (39weeks + 0 days- 40weeks + 6 days) because this will reduce the burden of perinatal and maternal morbidity and mortality without increasing caesarean section rate [21,24].

The limitation of the study is being a retrospective cross-sectional type where data entry and documentation quality might not be guaranteed. The exclusion of case files with incomplete documentation also precluded complete analysis and this might introduce errors that would affect the interpretation of the results.

In conclusion, this study showed that IOL remains a safe obstetric procedure that would continue to be relevant in developing countries where women do not want caesarean delivery. The use of combined Foley's catheter and vaginal misoprostol for cervical ripening before IOL and estimated fetal weight between 2.5 and 3.9kg were associated with a high rate of vaginal delivery and good maternal and perinatal outcomes. This should be adopted in clinical practice. A prospective randomized trial comparing Foley's catheter and misoprostol, Foley's catheter and oxytocin and Foley's catheter and early artificial rupture of membranes will be considered in future research.

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