Original Article

Feto-maternal outcome of induced versus spontaneous labour in a Nigerian Tertiary Maternity Unit

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ABSTRACT

Background: Induction of labour may be associated with postpartum haemorrhage, instrumental delivery, blood transfusion, longer hospital stay and admission into neonatal intensive care unit.

Objective: To assess the feto-maternal outcome of induced labour compared to spontaneous onset labour.

Materials and Methods: Prospective comparative study involving 440 participants divided into induction (study) and spontaneous labour (control) groups. Data were collected on socio-demographic data, maternal complications, blood transfusion and neonatal outcomes.

Results: A total of 1540 deliveries occurred during the study period, out of which 257 had induction of labour. Successful induction rate was 16.47%. Vaginal delivery was 67.6% in the study group compared to 83.4% in the control group. Postdated pregnancy and hypertensive diseases accounted for 56.8% and 28% of the indications for induced labour, respectively. Induced labour was associated with a significantly higher caesarean section rates ($P < 0.001$). Cephalo-pelvic disproportion was the most common indication for caesarean section ($P = 0.038$). Maternal complications include primary postpartum haemorrhage, perineal lacerations and endometritis. The study group had longer duration of hospital stay compared to the control ($P < 0.001$). Five perinatal mortality occurred among the study group compared to three in the control ($P = 0.848$).

Conclusion: Induction of labour is associated with increased risk of caesarean delivery and postpartum haemorrhage compared with spontaneous labour, however, overall rates remain low.

Key words: Induced labour; maternal complications; neonatal outcome; spontaneous labour.

Introduction

Induction of labour is one of the most common and important obstetric interventions. It is usually indicated when the benefits of delivery of the fetus outweighs the risk of continuing the pregnancy.[1] The incidence varies between and within countries and regions. It is higher in developed countries than in the developing countries due to increasing rate of elective induction.[2] Incidence of 22.5% has been reported in the United States of America,[3] 5–13% in the Sub-Saharan Africa[4] and 5–6% in South Africa.[1] In Nigeria, incidence of 18–23% has been reported in Benin[4] and 3% in Sokoto.[5]

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The indications for induction of labour must be established before this intervention is instituted. These indications have been classified as obstetric indications, medical indications and elective or social indications. Obstetric indications include prolonged pregnancy, hypertensive disease in pregnancy, intrauterine growth restriction (IUGR), Rhesus iso-immunization and intrauterine foetal death (IUD). Medical

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indications include chronic hypertension, diabetes mellitus, haemoglobinopathies, chronic renal diseases and liver diseases co-existing with pregnancy.[2] Elective induction is also referred to as social induction performed at patient's or doctor's convenience. There is a consensus that the success of induced labour is directly related to the favourability of the cervix, as adjudged using the Bishop's scoring system. The risk of failed induction with consequent higher caesarean section rate has been observed in those that are induced with an unfavourable cervix.

The effect of induction of labour on the duration of labour, feto-maternal outcomes and complications of labour has been equivocal. While some studies suggest that induction of labour increases the risk of complications such as postpartum haemorrhage (PPH) due to uterine over-activity or atony post-partum from uterine fatigue, others have observed increased caesarean section rate on account of foetal distress.[6,7] The risk of caesarean section following induction of labour increases with nulliparity, obesity, advanced maternal age, foetal macrosomia and chorioamnionitis. It is also associated with an increased risk of instrumental vaginal delivery, blood transfusion, longer hospital stay, need for immediate care of the newborn and admission into neonatal intensive care unit (NICU).[6] However, some of these perinatal outcomes may be related to the very pathological conditions that led to an indication for induction of labour rather than the induction of labour process itself.[7-9]

Another prospective study suggested that in women with postdated pregnancy, induction may not increase or even lower the risk of caesarean section and adverse foetal outcomes.[7] In our environment, there is a great aversion for caesarean section. The situation is worsened by the belief in some cultures that a woman who delivers through caesarean section is not a complete woman.[7] Postdated pregnancies are known to be associated with an increased risk of foetal demise. As pregnancy advances beyond 38 weeks, there is associated increasing placental insufficiency with resultant decrease in foetal oxygenation with attendant relative hypoxia.[8] There is also a progressive reduction in amniotic fluid volume, which may result in oligohydramnios. This may be further complicated by cord compromise and an increased risk of meconium aspiration.[9] Induction of labour conducted after 41 weeks could help to prevent these complications. However, a woman who prefers to wait for spontaneous labour must be monitored for foetal well-being up to a maximum of 42 weeks to detect foetal compromise. This monitoring includes daily foetal kick chart, alternate daily non-stress test using cardio-tocography and biophysical profile.

In developing countries like Nigeria, sophisticated monitoring methods are not readily available and affordable which makes induction of labour a preferred method to awaiting spontaneous onset of labour after 41 completed weeks.[10] This study was designed to assess the feto-maternal outcome of induced versus spontaneous labour in our busy maternity unit.

Aim and objective

To assess the feto-maternal outcome of induced labour compared with spontaneous onset labour in a tertiary maternity unit.

Materials and Methods

This was a prospective comparative study conducted in the Maternal and Child Centre, Ifako-Ijaiye, which is an affiliate of Lagos State University Teaching Hospital, Ikeja, Lagos. Ethical clearance was obtained from the health research and ethics committee. Informed consent was also obtained from each patient prior to inclusion. The study was a prospective comparative study conducted between pregnant women who had induction of labour and those of comparable gestational age who had spontaneous labour from 1st April to 30th September, 2013.

A total of 440 patients participated in this study. Two hundred and twenty women who had indicated induction of labour (study group) were compared with 220 women with spontaneous onset labour in active phase with cervix at least 4 cm dilated (control group). Inclusion criteria were live singleton fetus, vertex presentation and gestational age at term up of >41 completed weeks, with a modified bishop score of at least >6. Exclusion criteria included mal-presentation, contracted pelvis, abnormal placentation, multiple pregnancy, foetal macrosomia and non-reassuring foetal status, foetal death, gestational ages less than 37 weeks and unfavourable cervix. Gestational age was previously determined by the last menstrual period and/or early ultrasonography scan done in first half of pregnancy.

A structured proforma was used to obtain socio-demographic information of the participants, parity, gestational age at delivery and booking status. Cervical assessment was done in an antenatal clinic, and those with Bishop score <6 had cervical ripening done with intra-cervical extra-amniotic Foley's catheter size 24 F passed and its balloon inflated with 40 ml of sterile water the evening preceding the day of induction with average time of about 12 h. Pre-induction cardiotocography was done in all cases to exclude fetuses with non-reassuring tracings and admission cardiotocography

was done for those who presented with spontaneous labour. Bishop scoring is repeated on the morning of induction with the patients in the labour wards prior to the procedure for favourability. A Bishop's score of 6 or more was said to be favourable. In addition, women who came into the labour ward on the same day in spontaneous labour and fulfilled the inclusion criteria above were randomly selected for comparison.

In our obstetric unit, induction of labour is by synchronous amniotomy with oxytocin infusion in the presence of a favourable cervix. The protocol for oxytocin administration is a gravity fed intravenous infusion of 5.0 IU for primigravidae and 2.5 IU for multigravidae, of oxytocin in 500 ml of 5% dextrose in saline. This was commenced at 10 drops per min and titrated by increasing the rate of drops every 30 min to 20, 30, 40 up to 60 drops per min until uterine strong contractions of 3 to 5 in 10 min each lasting approximately 45–60 s is established with a maximum rate of 60 drops per min (equivalent to 40 mu/ml).

Labour progress was charted on the partograph. Intermittent foetal heart rate (FHR) auscultation using the sonicaid monitoring and palpation for uterine activity was performed in all patients. Maternal vital signs were also monitored. Abnormal FHR patterns included foetal tachycardia, or bradycardia, late decelerations or moderate-to-severe variable FHR decelerations. Abnormal uterine contractions was defined as (1) tachysystole; at least six contractions in 10 min for two consecutive 10-min periods; (2) hypertonus; as a single contraction of at least 2 min (3) hyperstimulation syndrome; as tachysystole or hypertonus associated with foetal heart tachycardia or late decelerations. These complications were treated by changing maternal position to left lateral, by nasal oxygen administration and stopping the oxytocin infusion. If the foetal heart rate failed to return to normal after these measures, recourse to emergency caesarean section was taken.

Data on the course of labour including induction to delivery time and maternal and fetal outcomes with complications were also noted in the structured proforma. Successful induction was defined as successful vaginal delivery and failed induction as failure of vaginal delivery leading to caesarean section irrespective of the indication.

Data obtained was analyzed using SPSS version 16.0 (Statistical Package for Social Science, Inc. Chicago III). Descriptive and inferential statistics were applied in the course of analysis. Proportions and percentages were calculated for categorical variables. Pearson's Chi-square test and student's *t*-test (a non-parametric inferential statistical procedure) were used to assess relationships and statistical significance between categorical variables. $P < 0.05$ was considered to be statistically significant at 95% confidence interval.

Results

The total number of deliveries during the study period of 6 months was 1540. Two hundred and fifty four (254) patients had induction of labour giving an induction rate of 16.49%, of which 220 participants who met the inclusion criteria were included in the study group. These were compared with 220 patients who had spontaneous onset of labour (control group) and were selected consecutively. Ninety four percent (94%) of the patients in both the groups were booked. The mean age of the participants was 29.30 ± 4.03 years for the study group and 28.76 ± 4.38 years for the control group, with no statistically significant difference ($t = 1.358$, $P = 0.175$). The mean gestational age at delivery was 40.25 ± 1.33 for the study group compared to 39.33 ± 1.03 for the control group showing statistically significant difference ($t = 8.107$, $P =< 0.001$).

Nulliparous women accounted for 57.3% (126) and 61.8% (136) in the study and control groups, respectively. Postdated pregnancy accounted for 56.8% of all the indications for induction of labour, followed by hypertensive diseases in pregnancy (28.8%). Other indications included rhesus negative, gestational diabetes and sickle cell disease at term. Vaginal delivery in the study group was 67.6% compared to 83.4% in the control group, giving a caesarean section rate of 32.4% and 16.6% in both the groups, respectively. This was found to be statistically significant (χ^2 (1) = 14.750, $P = 0.0014$). Cephalopelvic disproportion was the most common indication for caesarean section in both groups at 48.6% in the study compared to 69.4% in the control. This was statistically significant with $P = 0.038$. On the other hand, foetal distress was the second most common indication at the rate of 40.9% in the study group compared to 30.6% in the control group. This was also statistically significant with $P = 0.028$.

There was no statistically significant difference between mean induction to delivery time (6.8 ± 2.16 h) compared to the duration of active phase of labour in the control group (6.64 ± 3.20), $P = 0.452$ [Table 1]. Ten participants in both the groups had instrumental vaginal delivery with predominance of ventouse (8 in study versus 6 in control group). Notable maternal complications of no statistical significance include primary postpartum haemorrhage 10 (4.55%) in the study versus 5 (2.27) in the control group, second-degree perineal lacerations 9 (4.09%) in the study versus 14 (6.36%) in the

control and endometritis (3 in the study versus 1 in the control group) ($P = 0.238$) [Table 1]. However, postpartum haemorrhage was noted in 10 (4.55%) participants of the study group, with 3 requiring blood transfusion compared with 5 (2.27%) from the control group, 1 of whom underwent blood transfusion. There were 5 cases of uterine hyper-stimulation in the study group, 3 of whom were multipara. There were 3 cases of endometritis in the study group compared to 1 in the control group. The study group had significantly longer duration of hospital stay 2.89 ± 2.68 days compared to the control 1.86 ± 1.97 (χ^2 (1) = 14.750, $P < 0.001$). For those who had caesarean section, the mean duration of stay was 7 ± 4 days for either group. There was no maternal death recorded among the women studied.

The mean Apgar score was 6.22 ± 1.46 and 6.35 ± 1.45 at 1 min ($P = 0.356$); 8.33 ± 1.28 and 8.4 ± 1.37 at 5 min ($P = 0.567$) for babies in study and control groups, respectively [Table 2].

Considering the gestational age (GA) at delivery and 5-min Apgar score above 7, 88% of the babies in the study group achieved Apgar score >7 compared to 90.5% of the control group at GA between 37 and 40 weeks; $\chi^2 = 5.498$, $P = 0.094$. Moreover, 85.7% babies in the study group achieved Apgar score >7 compared to 82.3% of the control at GA above 40 weeks; $\chi^2 = 3.218$, $P = 0.360$ [Table 2]. This difference was not statistically significant.

Neonatal intensive care unit (NICU) admission was required for 7.3% (16) of the babies in the study group compared to 3.6% (8) in the control group ($P = 0.087$). These consist of birth asphyxia (10 versus 5), presumed sepsis (5 versus 1), macrosomia (1 each) and meconium aspiration (0 versus 1) in the study and control groups. However, there were more babies admitted on account of sepsis in those delivered following induced labour. The mean duration of admission of babies in NICU was 7.0 ± 3 days. Seven babies in the study group compared to 3 in control were admitted for 1–3 days in NICU, whereas 9 and 5 babies were admitted for >3 days in the study and control groups, respectively. There were 7 neonatal deaths, 4 in the study group and 3 in the control group. Birth asphyxia was the cause of death in all 3 babies delivered in the control group compared to 1 in the study group [Table 2]. Neonatal sepsis accounted for the remaining three deaths in the study group [Table 2].

Table 1: Labour outcomes among comparison group

	Spontaneous (Control) *n* (%)	Induced (Study) *n* (%)	*P* (χ^2)
Mode of delivery			
Vaginal delivery	184 (83.6%)	149 (67.7%)	*< 0.001
Caesarean Section	36 (16.4%)	71 (32.3%)	
Indication for C/S			
Cephalopelvic disproportion	25 (69.4%)	34 (48.6%)	*0.038
Foetal distress	11 (30.6%)	28 (40.0%)	
Cervical dystocia	0	6	
Failed instrument delivery	0 (0.0%)	3 (11.2%)	
Total	36	71	
Maternal complications			
Post partum haemorrhage	5 (25.0%)	10 (45.5%)	0.238
Lacerations (excluding episiotomy)	14 (70.0%)	9 (40.9%)	
Infection (endometritis)	1 (5.0%)	3 (13.6%)	
	Mean±S/D	**Mean±S/D**	***P* (*t*-test)**
Duration of labour (hours)	6.64±3.20	6.87±2.16	0.452
Duration of hospital stay (days)	1.86±1.97	2.89±2.68	*<0.001

*Significant at 95% confidence level with Pearson Chi-square test (χ^2)/students *t*-test (*t*). χ^2 (1) = 14.750, $P<0.001$ (two-tailed)

Table 2: Neonatal outcomes among comparison group

	Spontaneous (Control) *n* (%)	Induced (Study) *n* (%)	*P* (χ^2)
NICU admission			
Yes	8 (3.6%)	16 (7.3%)	0.087
No	212 (96.4%)	204 (92.7%)	
Indications for admission			
Birth asphyxia	5 (62.5%)	10 (62.5%)	
Foetal macrosomia	1 (12.5%)	1 (6.5%)	
Presumed sepsis	1 (12.5%)	5 (31.0%)	
Meconium aspiration	1 (12.5%)	0 (0.0%)	
Eventual NICU outcome			
Alive	5 (62.5%)	12 (75.0%)	0.848
Dead	3 (37.5%)	4 (25.0%)	
	Mean±S/D	**Mean±S/D**	***P* (*t*-test)**
Apgar score @ 1 minute	6.35±1.45	6.22±1.46	0.356
Apgar score @ 5 minutes	8.40±1.37	8.33±1.28	0.567
Mean Birth Weight	3.285±0.642	3.463±0.819	0.283

*Significant at 95% confidence level with Pearson Chi-square test (χ^2)/Students` *t*-test (*t*)

Discussion

The goal of induction is to achieve a successful vaginal delivery that is as natural as possible.[10] Evidence-based medically indicated inductions of labour are generally considered within a risk-benefit decision making process, in which the risks of the medical condition worsening or causing harm are balanced against the risks of an induction of labour.[11] The rate of induction from this study was 16.49% of the total deliveries. This rate is higher than the values reported for other parts of Nigeria. It was 6.6% in Maiduguri,[12] 6.8% in Ibadan[13] and 11.5% in Ogoja,[14] however, lower than 22.5% in the United States of America[15] and 21.8% in Canada.[16] The higher rates seen in Canada and United States of America could be due to the increase in elective induction observed in developed countries.

The successful vaginal delivery rate in those induced was 67.6% compared to 83.4% in those with spontaneous labour. This difference was statistically significant, which is in agreement with those documented in the literature.[4,5,14,17] Comparatively, the successful induction rate from this study was lower than 82% reported by Ekele *et al*.[5] and 90.4% by Orhue *et al*.[4] from other teaching hospitals in Nigeria. Our successful induction rate was, however, similar to that reported in the large Latin American Study.[15] Orji *et al*. achieved successful induction of labour in 64.7% nulliparous women following use of vaginal misoprostol compared to 72.1% in among who had spontaneous labour.[7]

In this study, induced labour was associated with a higher caesarean rate (32.3%) compared to 16.4% in those who had spontaneous onset labour. This finding is consistent with other studies.[18-20] A Cochrane review of 58 trials involving more than 11000 women concluded that although oxytocin reduced the rate of unsuccessful delivery within 24 hours compared with expectant management (8.3% versus 54%), the caesarean section rate was increased (10.4% versus 8.9%).[17] It was noted that, while the goal of labour induction is to achieve successful vaginal delivery, the induction exposes women to a higher risk of caesarian section than spontaneous labour.[10]

Caesarean section rate in this study was observed to be higher in nulliparous women compared to multiparous women in both the induced and spontaneous labour groups. This was similar to findings of Orji *et al*.[7] Women with induced labour for medical indication have a greater overall odds of caesarian section; this may be due to the effect of underlying confounders rather than the induction itself.[21] The indications for induction in this study were mainly post-datism (56.8%) and hypertensive disease of pregnancy (28.8%), whereas others were Rhesus negative, gestational diabetes and sickle cell disease in pregnancy. These were high risk pregnancies that required termination with induction of labour to prevent adverse perinatal and maternal morbidity and mortality.

Failed induction in this study was mostly due to cephalopelvic disproportion (34 vs 25), fetal distress (28 vs 11), cervical dystocia (6 vs 0) and failed instrumental delivery (3 vs 0) in the study and control groups respectively [Table 2]. This finding was similar to other studies.[7,22,23] However, Ezechi *et al*. listed cephalo-pelvic disproportion, fetal distress, prolonged labour and antepartum haemorrhage as causes of their failed induction.[24] In these circumstances, caesarean section became the inevitable option emphasizing the need for proper and adequate counseling prior to the commencement of induction of labour.

The mean induction to delivery time was 6.64 ± 3.20 h when compared with the active phase of labour to delivery time in the spontaneous onset labour group (6.87 ± 2.16 h). This was comparable to a mean duration of (6.08 vs 6.50 h) reported by Orji *et al*. in similar groups.[7] The fact that the mean duration of labour was similar between induced versus spontaneous labour groups indicates that induced labour is not necessarily associated with prolonged labour in the presence of adequate monitoring.

Postpartum haemorrhage complicated more of the induced labour (4.5%) than spontaneous labour cases 2.3%, however, this was not statistically significant. These values were higher than 2.2% for induced and 1.3% for spontaneous, respectively, reported by Selo-Ojeme *et al*.[23] Postpartum haemorrhage in this setting resulted from excessive uterine stimulation and increased predisposition to uterine atony due to postpartum uterine exhaustion associated with the use of uterotonic agents, especially oxytocin. On the other hand, 3rd and 4th degree lacerations occurred more with spontaneous labour (9 vs 14); this finding is similar to what was observed in other studies.[5,7] Uterine hyperstimulation of 2.3% observed in women who had induced labour was less than 8.4% reported by Selo-Ojeme *et al*.[23] It was managed by hydration with normal saline, analgesia, oxygen and discontinuation of oxytocin. If not corrected, uterine hyperstimulation can lead to foetal distress and even uterine rupture with a high maternal and perinatal morbidity and mortality. However, there was no case of uterine rupture in this study.

The women in the induction group were noted to have a longer duration of hospital stay. Two factors may have contributed to this. First, women planned for induction of labour were admitted to the hospital a day before the procedure. This led to increased in-hospital pre-delivery time. Second, the higher caesarean delivery rate in the induction group was associated with a longer post-delivery length of stay. This was similar to finding in other studies.[24,25] The economic impact of length of stay has been studied and it was thought to contribute to the higher costs associated with the induction of labour.[26]

The neonatal Apgar scores at 1 and 5 min were comparable between both groups and showed no statistically significant difference. However, a higher proportion of the babies delivered following induction of labour after a gestational age of >40 weeks had better Apgar scores at 5 min when compared with those who had spontaneous labour. This finding was in agreement with that reported by Orji *et al*.[7] Postdated pregnancies are known to be associated with an increasing risk of fetal demise. As pregnancy advances

beyond 38 weeks, there may be associated placental insufficiency with resultant decrease in fetal oxygenation and an attendant relative hypoxia.[9] During labour, the relative hypoxia worsens with uterine contractions so that a prolonged labour as may occur in nullipara will jeopardize fetal outcome, especially if this occurs in the presence of postdatism.[9] Despite reactive CTG being part of the recruitment criteria, 10 (5.5%) neonates in the study and 5 (2.8%) control groups were admitted to NICU on account of birth asphyxia. Selo-ojeme *et al*.[23] noted that the rate of adverse neonatal outcome (poor Apgar score and low arterial cord pH) which was higher in their induction group may be related in part to uterine hyperstimulation.

The eventual neonatal outcome shows that there were 4 neonatal deaths among the study group compared with 3 deaths in the control group, giving a perinatal mortality rate of 13.6 per 1000 births. The causes of these deaths were mainly neonatal sepsis in the study group and birth asphyxia in the controlled group.

This study is not without its limitations. Specific indication for induction might have contributed to failed induction in the identified cases. Accurate determination of the actual concentration of oxytocin delivered to each patient was not possible because of the non-availability of infusion pumps, and this may have influenced the successful induction rate observed in this study. However, pre-labour CTG is only a guide and is not a definitive predictor of the final fetal outcome of labour. Post-mortem examinations were not conducted on the neonatal deaths to exclude possible congenital anomaly.

Successful induction rate, labour-delivery interval and perinatal outcomes in this study were comparable to those documented in other studies. Though induction of labour is associated with increased risk of caesarean delivery and postpartum haemorrhage compared with spontaneous labour, the overall rates of these complications remain low. Although induction of labour is a safe procedure, the indication for induction and the resources available at the institution of care of the woman and her newborn must be taken into consideration when induction of labour is indicated.

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Conflicts of interest
This work has no potential conflicts of interest, whether of financial or other nature.

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