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Predictors for successful induction of labour at Muhimbili National Hospital

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ABASTRACT

Induction of labor is the use of techniques for stimulating uterine contractions to accomplish vaginal delivery prior to the onset of spontaneous labor. 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.

The practice of induction of labor at Muhimbili National Hospital is faced with low success rate of about 60% compared to more than 80% success in the developed world. The low success rate of IOL at MNH could be contributed by factors beyond the known predictors for induction success. The study intended to identify the predictors for successful induction of labour at Muhimbili National Hospital.

Methodology: Analytical cross-sectional study on women undergoing induction of labor at MNH. These were women with indication for IOL, single viable fetus with cephalic presentation, gestational age of ≥ 28 weeks, recruited consecutively before IOL until sample size was reached. Social demographic, obstetric characteristics were obtained through patient interview and methods of inductions, time of initiation of first dose were obtained from the patients files, all these were collected using a structured questioner, then analysed using SPSS version 23 computer program.

Univariate analysis was used to describe socio-demographic characteristics, while Bivariate and multivariate were used to determine the association of factors with success of induction of labor. P value <0.05 was considered statistically significant in all tests of significance.

Results; The study included 400 women, of these participants, 297(74.2%) had success of vaginal delivery while 103(25.8%) had failure of IOL. The hypertensive disorders were the commonest indications of IOL 182(45.5%) followed by post-date 103(25.7%). Methods of IOL, number of doses of prostaglandins used, parity (AOR 1.8; 95%CI= 1.1,1.3), favorable cervix (AOR=5, 95% CI=1.8,13.6), term (AOR=2;95% CI=1.3,3.7) and postterm pregnancy (AOR=2.8; (95% CI=1.5,5.4) were independently associated with success of IOL. Other characteristics such as maternal age and fetal weight were not associated with success of IOL.

Conclusion: The main predictors of the outcome of IOL were Bishop score greater than 7, term and postterm, use of amniotomy with oxytocin, misoprostol and parity greater than one. IOL carries high risk of maternal morbidity, it is mandatory to assess predictors for success of before IOL.

Keywords: Induction of labour; Predictors; Success of induction of labour.

Background

Induction of labour is defined as the process of artificially stimulating the uterus to accomplish vaginal delivery prior to the onset of spontaneous labor (1).The World Health Organization (WHO) recommends induction be performed with a clear medical indication and when expected benefits outweigh potential harms (2). The rate of induction of labour differs from one place to another depending on the availability of resources and population. Globally, the rate of IOL is highest in developed countries 20% and lowest in Africa 4.4% among all deliveries conducted in these settings. The low rate of IOL in Africa was contributed by, place of residence, inequitable distribution of health infrastructure and availability of health skilled personnel (3). The rate is 12.1% in Asia (4) and 11.4% in the Latin America (5). Rates of IOL in some African countries are 3% in Nigeria (3),3.2% in Democratic Republic of Congo (6), and 2.3% in Muhimbili Nation Hospital (7).

There are different indications of IOL. These include hypertensive disorder in pregnancy, significant but stable antepartum hemorrhage like abruption placenta, Chorioamnionitis and term pre-labour rupture of membranes. Other indications are Postdates or post-term pregnancy, Uncomplicated twin pregnancy ≥ 38 weeks, Diabetes mellitus (glucose control may dictate urgency), Alloimmune disease at or near term, Intrauterine growth restriction, Oligohydramnios, Intrauterine fetal death, (8,9).

In modern obstetric practice there are several approaches to the IOL. These include mechanical methods, surgical, medical/pharmacological (8). Mechanical methods include use of balloon catheter, membrane sweeping and laminaria. Surgical methods include amniotomy while medical/ Pharmacological method includes use of oxytocin and prostaglandins analogues such as misoprostol and dinoprostone (8,10).

Success of induction depends on many factors that

surround the induction process. For many decades the Bishop score is being used as the main predictor for success of induction. The scoring system has 5 components which include cervical dilatation, effacement, position and consistency; and fetal station (8). In recent years cervical effacement has been modified to cervical length in the modified Bishop score .It uses a scoring system, whereby a score ≤ 6 is considered unfavorable cervix. The score of ≥ 6 is considered favorable that the chances of successful vaginal delivery is high (11). Bishop score does not predict the success of IOL in all women. This means there are other factors that predict the likelihood of induction success (12). These factors include Body Mass Index, maternal age, parity, gestational age, fetal weight, and diabetes (13). This study will evaluate factors such as maternal age, parity, gestational age, fetal weight, Bishop score and facility factors on success of IOL.

IOL is contraindicated in vasa previa or complete placenta previa transverse fetal lie, previous classical cesarean delivery, active genital herpes infection, previous myomectomy entering the endometrial cavity (13). Other contraindications include breech presentation, borderline clinical non-reassuring fetal testing that does not require emergency delivery, polyhydramnios (12).

Labour induction may result in undesirable effects which include failure to achieve labour, Caesarean section (failure to achieve vaginal delivery), operative vaginal delivery, tachysystole with or without fetal heart rate changes, chorioamnionitis, cord prolapse, inadvertent delivery of preterm infant in the case of inadequate dating and Uterine rupture (8). IOL is common procedure which is practiced at MNH.

Despite the fact that this procedure reduces caesarian section yet little is known about the predictors for successful IOL. Therefore this study intends to determine the predictors of successful induction of labor.

Methodology

Study area:

The study was conducted in the maternity block at MNH in Dar-es-salaam. There are 4 antenatal and postnatal wards, one labor ward and one high dependent unit ward (ward 35). It has a total capacity of 385 beds where 353 beds are situated in antenatal and postnatal wards, 20 delivery beds are in the labor ward and 12 beds are in the high dependent unit. It has an average of 800-900 deliveries per month and an average of 3 patients are induced per day.

The standard hospital protocols for IOL at MNH are; inductions are done in ICU and antenatal wards by the specialists, resident or registrar in consultation with the specialist on call. The induction is done in emergency and elective cases. The pregnant women scheduled for IOL from antenatal clinic are admitted one day prior to the procedure. The decisions for IOL and pre-cervical assessments are made by attending doctors and are responsible to decide type of drugs to be used for favorable and unfavorable cervix. Bishop Score is recorded at the initiation of induction, and if the Bishop Score is equal to 7 or more that is the cervix is favorable, labor is induced with amniotomy, and if uterine

contractions are not established is augmented with oxytocin. If Bishop score is <7cervical ripening is done by PGE. The induction procedure with misoprostol 25mcg is initiated while the women are kept in the antenatal wards or ICU ward. Induction with 3mg of dinoprostone tablets, are inserted vaginally or intracervical, at 6 hours interval with maximum of two doses. The patient is reassessed 6 to 8 hours after the initial PGE insertion, and depending on the response of the cervix as indicated by the Bishop Score, another dose of PGE may be inserted until maximum of four doses for misoprostol and 2 doses for dinoprostone. Once in active phase of labor they are transferred to labor ward for delivery or augmentation with amniotomy and I.V oxytocin if necessary. Amniotomy for known HIV positive is done once dilatation of cervix is seven or above.

Oxytocin infusion rates for induction of labour are administered as per WHO (2) protocol, the dose is prescribed according to parity, starting with 1.25IU or 2.5IU or 5IU in 500mls of normal saline/ringer lactate equals to10mU/ml which is infused by counting drops/min, on which 15-20drops are equivalent to 1ml. Infusion begin at 10 drops/minute, dosage increased every 30min by 10 drops/minute, until regular strong contraction is achieved (e.g; 3-4 contractions in 10min) the maximum dose is 60drops/min. Thus the initial dose is approximately 6mU/min and maximum is approximately 40mU/min. Fetal wellbeing is established by moyo, fetal scope or Doppler measured after every ½ hour. Labor is monitored by using partograph. There must be no evidence of fetal distress. Oxytocin is prescribed with great caution in multiparous and a malposition to avoid rupture of the uterus.

Data collection techniques

The participants were recruited from antenatal ward. They were enrolled after a decision to induce labour had been made by the attending doctors. They were explained on the aim of study. Those agreed to participate in the study were assessed for inclusion criteria (Appendix2) and then were enrolled consecutively prior to IOL until sample size was reached. Principal investigator was responsible to collect all information regarding socio-demographic and obstetric characteristics which was obtained through patient interview. In supine position fetal lie was identified and heart rate was assessed by fetoscope or Doppler. Bishop score was done by the Principal investigator. A method of inductions was decided by attending doctors but the decision changed depending on the precervical status. Those participants with favorable cervix, IOL was done by armniotomy followed by I.V oxytocin, while those with unfavorable IOL started with prostaglandins then followed with or without armniotomy and oxytocin. Monitoring and review of participants was done according to the hospital protocol. Data on the number of doses used, amount of oxytocin administered, APGAR score, birth weight, mode of delivery were recorded from patient's files, delivery book and theatre report book.

Data management

The questionnaires were coded to make the data entry easy. All raw data was reviewed by the principal investigator and cross-checked to ensure completeness, and all incomplete data were traced through round book and patients files.

Data analysis and presentation

Data was analyzed by using SPSS-version 23 and presented in form of tables and percentages. Categorical data were summarized as proportions and continuous were summarized as means and standard deviations (e.g; maternal age). The contingency table was formed between the outcome and exposure variable. The exposure variables formed the rows in the tables while the outcomes were presented in the columns. Bivariate analysis was done to determine the association between the outcome variable which is success for IOL and independent variables which includes maternal age, Bishop score, fetal weight, parity, gestational age and methods of induction. Then multivariate analysis was done in order to examine the influence of the selected independent variables in the Bivariate analysis on the outcome variable. The p-value of less than 0.05 was considered significant.

Ethical Considerations

Participants informed about the study objectives. They were assured that if they agreed to participate in the study, they had the right to withdraw at any point in time. If they would not wish to participate, they were assured that there was no implications for them and even on the services they are seeking .Care was taken to ensure that respondents 'confidentiality was maintained throughout the study. Counseling was done to women who delivered a stillbirth. A written consent suffice one to be included in the study.The study was approved by Muhimbili University of Health and Allied sciences senate of research and publications comitee (SRPC) and authorities of MNH.

Study results

The total number of deliveries during the study period was 4,084, of which 515 underwent IOL, and 400 met the inclusion criteria. The prevalence of IOL was 8%. Of the 400 women induced, 297 (74.2%) had successful vaginal delivery while 103 (25.8%) had to undergo caesarian section. The median time of initiation to onset of labour was 9.5 (Range 0-50hrs), also the median time for induction to delivery was 13(Range 0-56hrs).

Study flow chart

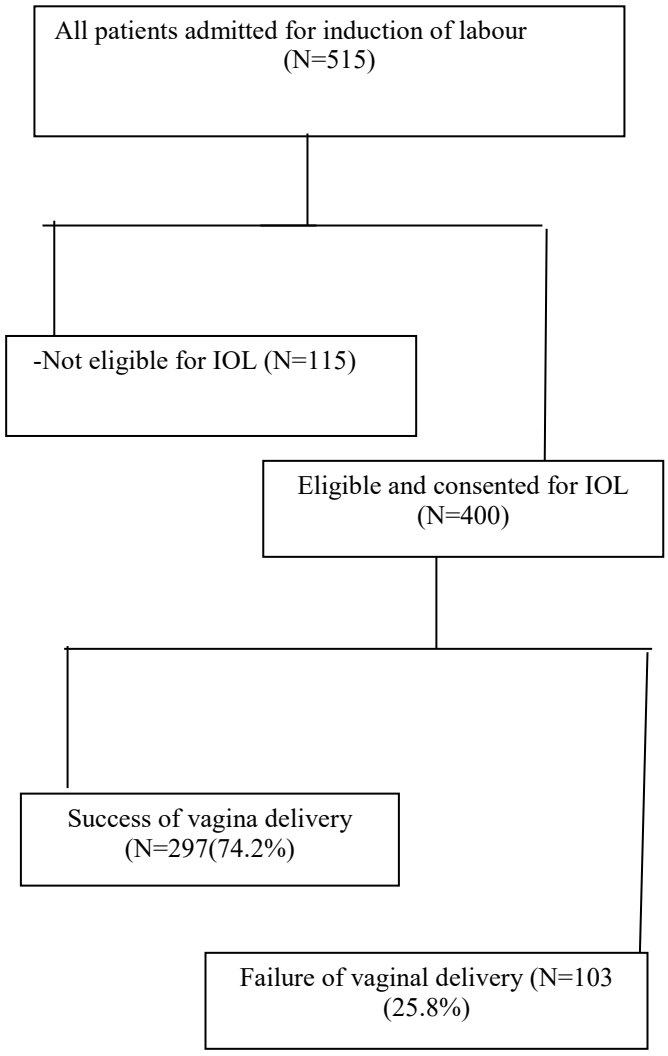

Table 1: Demographic and obstetric characteristics of women undergoing induction of labour at MNH (N= 400)

Characteristics	Number (Frequency)
Age in years	
15-29	224(56)
30-39	160(40)
40-49	16(4)
Marital status	
Single/divorced/separated	71(17.8)
Married	329(82.2)
Level of education	
No formal education	21(5.2)
Primary education	132(33.0)
Secondary education	130(32.5)
College	117(29.3)
Occupation	
Self employed	169(42.2)
Employed	118(29.5)
House wife	113(28.3)
Gravidity	
1	127(31.8)
2-3	172(43.0)
≥4	96(25.2)
Parity	
Zero	156(39)
1 and above	244(61)
Gestation age	
28-36	148(37.0)
37-40	141(35.2)
41-42	111(27.8)
Bishop score	
<7	323(80.7)
≥7	77(19.3)

The table above shows that average maternal age was 29.2(SD=5.6). The median parity was 1(Range 0-6), the average GA was 37.6(SD=3.4) and 77(19.3%) had Bishop score ≥7.

Table 2: Indications and methods of IOL in the study participants at MNH (N= 400)

Indications and methods	Number (%)
Indications for IOL	
Hypertensive disorder in pregnancy	182(45.5)
Postdate	103(25.7)
Term and PROM	55(17.5)
GDM	7(1.7)
Others	38(9.5)
Methods of induction	
ARM and oxytocin	77(19.3)
Misoprostol	93(23.3)
Dinoprostone	230(57.4)
Time of initiation of IOL	
Morning	293(73.2)
Evening	107(26.8)
Dose of misoprostol used	
First & Second doses	54(13.5)
Third& Fourth doses	39(9.7)
Other methods	307(76.8)
Dose of dinoprostone used	
First	85(21.2)
Second	145(36.3)
Other methods	170(42.5)

GDM: gestational diabetic mellitus, PROM*:* Premature rupture of membrane

Table 2 above shows that the commonest indication for IOL was hypertensive disorder in pregnancy 182 (45.5%) followed by postdate 103(25.7%). Dinoprostone was the commonest drug used for IOL 230 (57.4%). Majority of women were induced during morning shift 293(73.2%). The analysis revealed that indications for caesarian sections were; failed IOL 62(15.5%), obstructed labour 23(5.75%), Fetal distress 16(4%) and abruption placenta 2(0.5%).

Table 3: Outcome of labour of women undergoing induction of labour at MNH (N= 400)

Outcome of labour	Number (%)
Success of vaginal delivery	
Yes	297(74.2)
No	103(25.8)
APGAR score at 5min	
<7	34(8.5)
≥7	366(91.5)
Fetal weight	
<2.5kg	154(38.5)
2.5-4kg	237(59.2)
≥4kg	9(2.3)

Table 3; shows the success of vaginal delivery was 297(74.2%) and failure was 103(25.8%).Three hundred and sixty six (91.5%) of babies had Apgar score greater or equal to 7 and their average birth weight was 2766g (SD=0.76) and majority of babies weighed 2.5-4kg 229(59.2%).

3.3: Predictors for successful induction of labour

Table 4: Bivariate analysis of socio demographic and obstetric characteristics and associated with Success of Induction(N=400)

Characteristics	Number (%)	Success of IOL (n=297)	Failure of IOL(n=103)	P-value
Age in years				
15-29	224(56)	163(72.8)	61(27.2)	
30-39	160(40)	121(75.6)	39(24.4)	0.662
40-49	16(4)	13(81.3)	3(18.7)	
Parity				
Zero	156(39)	106(67.9)	50(32.1)	0.021
1 and above	244(61)	191(78.3)	53(21.7)	
Gestation age				
28-36	148(37.0)	93(62.8)	55(37.2)	
37-40	141(35.2)	113(80.1)	28(19.9)	0.000
41-42	111(27.8)	91(82)	20(18)	
Bishop score				
<7	323(80.7)	226(70)	97(30)	0.000
≥7	77(19.3)	71(92.2)	6(7.8)	
Methods of induction				
ARM and oxytocin	77(19.3)	65(84.4)	12(15.6)	0.000
Misoprostol	93(23.3)	81(87.1)	12(12.9)	
Dinoprostone	230(57.4)	151(65.7)	79(34.3)	
Time of initiation of IOL				
Morning	293(73.2)	217(74.1)	76(25.9)	
Evening	107(26.8)	80(74.8)	27(25.2)	0.887
Second	145(36.3)	80(55.2)	14(44.5)	

Table 4 above represents the bivariate analysis of the association between predictors for success of IOL and success of vaginal delivery. The success of vaginal delivery among women with more than one delivery was 191(78.3%). Factors which were significantly associated with successful induction of labour (P-value < 0.05) were parity, gestation age, bishop score and methods of induction.

Table 5: Univariate and Multivariate analysis of predictors on successful induction of labour among study participants (N =400)

Characteristics	COR	AOR
Parity		
Zero	1	1
1 and above	1.7(1.1,2.7)	1.9(1.1,1.3)
Gestation age		
28-36	1	1
37-40	2.4(1.4,4.1)	2.2(1.3,4.0)
41-42	2.7(1.5,4.8)	3.1(1.7,5.8)
Bishop score		
<7	1	1
≥7	5.1(2.1,12.1)	5(2.0,12.3)
Methods of induction		
ARM and oxytocin	2.8(1.4,5.6)	2.1(1.1,4.5)
PGE1	3.5(1.8,6.9)	4.3(2.2,8.6)
PGE2	1	1

Table 5 above shows the results of the multivariable logistic regression analysis. After adjusting for other factors independent predictors for success of vaginal delivery were parity, gestational age, methods of IOL, high Bishop score. Among women who had one and more deliveries the odds of success of vaginal delivery were about 2 times compared to nulliparous women (AOR=1.9; 95% CI=1.1,1.3). Moreover, women with Bishop score greater or equal to 7 had five times higher odds of success of vagina delivery (AOR=5; 95% CI=2.0,12.3) as compared to participants who had unfavorable score. Similarly, the odds of success of vagina delivery among women with term (AOR= 2; 95% CI=1.3,4.0) and postterm pregnancy (AOR=3.1; 95% CI=1.7,5.8) were 2 times higher as compared to preterm pregnancy.

Discussion

In this study the prevalence of IOL was 8% whereby successful vaginal delivery following IOL was 74.2%. The independent predictors for successful induction of labor in this study were gestational age, Bishop Score, method of induction and parity.

The proportion of women with success of vaginal delivery following IOL in our study is similar with results reported in some other African countries such as Congo (9), South Africa (24) and Kenya (3),. This may be due to the fact that majority of study participants were multiparous, as it has been known that the cervical status of multipara women during pregnant is usually favorable than nullpara women. Moreover this rate may be contributed by similar methods of induction used as well as number of doses of prostaglandins administered. However, the findings observed in this study are slightly low compared to the rate reported by developed countries (18,23,39). Generally, the variation observed in different studies may be due to difference in hospital setup and availability of different method of induction

Parity was found to be independently associated with success of vaginal delivery; women with more than one delivery had two times more success of labor induction compared to nullipara women. The higher rate observed in multipara women may be due to, state of the cervix prior to the IOL, normally multipara women had favorable Bishop score before IOL compared to nullpara, method of IOL used whereby in this study women induced with ARM and oxytocin had three times more success of vagina delivery. The findings are consistency with reported done by Khan et all 2012 (19) whereby about twenty five percent of nullpara women had failure of IOL. Rashida et al also found that multipara women had high success rate of vaginal delivery than nullpara women (3). However Bahar et al reported that parity had no association with success of IOL (39).

Furthermore, the gestational age was found to be independently associated with success of IOL, women with term and postterm pregnancies had a two fold increase in success of vaginal delivery compared to the preterm pregnancy.

The higher rate observed in term pregnancies may be contributed by size of the fetus, findings from this study showed that majority of participants delivered medium sized babies. Parity, methods of induction used, number of doses given as well as favorable cervix may facilitate success of IOL in these two groups. This findings correspond to the study done in Saudi Arabia where by the failure of IOL was more in preterm labor compared to term and postterm (18). In addition a study done in Ethiopia showed that women who had postterm pregnancy were more likely to delivery by caesarian section compared to preterm and term pregnancy may be due to macrosomic babies (40). The findings from Italy and Saudi Arabia showed that gestation age had no significant association with success of IOL (39,41).

Moreover, ARM and oxytocin was independently associated with success of vaginal delivery this may be contributed by majority of study participants had favorable cervix prior to IOL compared to women induced with misoprostol or dinoprostone. Balci et al (35) also reported that method of IOL had shown to be associated with success of IOL. However in Kenya the study showed there was no association between methods of induction and success of vaginal delivery (3). The variation may be due to difference in study population whereby only postterm pregnant women were recruited as compared to this study which took women irrespective of their gestational age.

Bishop Score greater or equal 7 was independently associated with the outcomes of induced labor. Women with favorable cervix had five fold increases in success of IOL as compared to those with unfavorable cervix. This may be contributed by methods of induction used, but also it may be due to condition of the cervix (ripening) at the start of induction as an important factor for the success of induced labor. This finding is supported with other studies done in other parts of the world (3,26,29,39). However Nikbakht et all reported that Bishop score was not a predictor for successful IOL, and this might be due to restriction on number of multiparous cases.

The strength of this study was all precervical assessment was done by a single person, which eliminated inter-observer errors or biases. The limitation of this study was that some participants who received more than one doses were not reviewed on time and almost all of these had failure of IOL.

Conclusions

The findings from this study indicate that the success of IOL in our setting was influenced by patients as well as facilities factors. The main predictors of the outcome of IOL were Bishop score greater than 7, term and postterm, use of amniotomy with oxytocin, misoprostol and parity greater than one.

Recommendations

- The results of this study gave important information on one of the most common intervention in the obstetric carrier, which is linked to reduce perinatal and maternal morbidities, mortalities and to reduce rate of caesarian section. In selecting methods for IOL women should be induced with ARM and oxytocin as it was seen from this study, the methods are associated with high success rate compared to others.
- Since the study was done in one of the tertiary hospital in Tanzania, the results may not be generalized, because other settings might have their own induction protocols. Therefore multicentre study of the similar objective can be considered inorder to obtain national data set for evaluating and monitoring this important intervention.

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Bmc –Pregnancy and child health

Competing interests

The authors declare that they have no competing interests.

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