

Success rate of labor induction and it's determinants at St. Paul's Hospital Millennium Medical College

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A research paper submitted to Saint Paul's Hospital Millennium Medical College, Department of Obstetrics and Gynecology as partial fulfillment for specialty certificate in Obstetrics and Gynecology.

ADDIS ABABA, ETHIOPIA

Feb.2017

**Success rate of labor induction and it's determinants
at St. Paul's hospital millennium medical college a
Cross-sectional study.**

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Summary

Introduction Induction of labor refers to the iatrogenic stimulation of uterine contractions before the onset of spontaneous labor to accomplish vaginal delivery. It has potentials for preventing maternal complications and improving pregnancy outcome. The objective of this study is to determine the success rate of labor induction and its determinants in St. Paul's hospital millennium medical college.

Methodology Hospital based cross sectional study was conducted to determine the success rate of labor induction and its determinants at St. Paul's hospital millennium medical college. Data was collected from July 1, 2016 till Dec. 17, 2016. Women who underwent labor induction in the study period and met the inclusion criteria were included. Data was entered in to SPSS statistical package version 20.0 and analyzed. Univariate and multivariate analysis used to see the association of the dependent and independent variables, $P < 0.05$ considered significant

Results- Four hundred two participants were included in the study. Majority 240(59.7%) were nulliparous. The commonest indication for labor induction was pregnancy induced hypertension occurring in 57.7% followed by PROM (20.9%) and oligohydramnios (13.2%). Two Hundred forty-six (61.2%) women had successful induction. One hundred fifty-four (38.3%) of the women who were induced underwent cesarean section. The commonest indication for cesarean section was failed induction 69(44.8%) followed by Non reassuring fetal heart rate pattern 66(42.9%). Mean duration till declaration of failed induction was 11.55hrs and the mean duration of rupture of membrane for those who underwent cesarean section for failed induction (excluding those who came with rupture of membrane) was 5.21 ± 3.43 hrs. Multivariate analysis showed multiparity and higher bishop score at the start of labor induction to be a strong predictors of vaginal delivery.

Conclusions and Recommendations Cesarean section rate is higher than comparative studies done in western setup. Factors significantly associated with success of induction were multiparity and higher bishop before the initiation of induction. Induction of labor should be made as much as possible after proper cervical ripening and time to declare failed induction should be prolonged.

Key words- induction, failed induction

Acknowledgement

My acknowledgement goes to the department of Obstetrics and Gynecology for giving me this chance to do this research and the research office for funding it.

I would also like to extend my heartfelt gratitude to my advisor Dr. Dilayehu Bekele for the constructive comments and support throughout the research process. I also like to extend my acknowledgement to Prof. Markos Tesfaye and Dereje Abate who had helped me a lot in the data analysis process. Last but not least I would like to acknowledge year 2 residents who were my data collectors for their fruitful input for this research to be conducted.

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List of Abbreviations

ARM	Artificial rupture of membranes
EONS	Early onset neonatal sepsis
IUFD	Intrauterine fetal death
IUGR	Intrauterine growth restriction
MDG	Millennium development goals
MSAF	Meconium stained amniotic fluid
NICU	Neonatal intensive care unit
PIH	Pregnancy induced hypertension
PROM	Premature rupture of membranes
SPSS	Statistical package for social sciences
SPHMMC	Saint Paul's hospital millennium medical college
WHO	World health organization

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1. Introduction

1.1 Background

Induction of labor refers to the iatrogenic stimulation of uterine contractions before the onset of spontaneous labor to accomplish vaginal delivery. (1) It is indicated when the benefits to the mother or the fetus outweigh the benefits of continuing pregnancy. (2)

It is deemed successful when it initiates uterine contractions, progressively dilates and effaces the cervix and leads to the normal vaginal birth of the baby with no maternal complications. Induction is deemed failure when active labor is not achieved or cesarean delivery is required. (2) There is currently no consensus as to what constitutes a “failed induction”, which is partly because of the fact that an induced labor may be non-progressive at different cervical dilatation and station. (2)

Two main factors associated with the safety and efficacy of induction of labor have been multiparity and favorable cervix, the method most commonly used to identify readiness for onset of labor is the modified Bishop score which includes quantitative measures of consistency and dilation of the cervix, and station and position of the presenting part. (3) The most favorable outcomes occur in cervixes which are soft and effaced. A cervix that is closed, firm and difficult to distend increases the likelihood of failed induction, longer duration of labor and caesarean section. (4) unfavorable cervix which probably is the most important factor and can be modified by means of ripening agents. (5)

Common cervical ripening methods include biochemical and mechanical agents. Mechanical ripening devices apply pressure on the internal Os of the cervix, overstretching the lower uterine segment and indirectly increasing localized secretion of prostaglandin. (5) It is usually performed

by administering oxytocin or prostaglandins to the pregnant woman or by manually rupturing the amniotic membranes. (6)

Oxytocin is a polypeptide hormone produced in the hypothalamus and secreted from the posterior lobe of the pituitary gland. It is identical to its synthetic analogue which is among the potent uterotonics known. (7) Intravenous oxytocin, available since the 1950s, has been the most commonly used method of induction for women with a viable pregnancy and favorable cervix. (8)

There is no international consensus on the dose regimen; different centers use different starting and increment dose regimen with a variation in the increment interval and maximum to be achieved. (7) The Oxytocin regimen used in Ethiopia is unique different for nulliparas and multiparas and has been commented as inconsistent, extremely high dose and with bizarre dose increment. (8)

At St. Paul's Hospital Currently over 800 deliveries are attended per month most of which are high risk deliveries of clients referred from the different catchment health centers in Addis Ababa and other health centers from Oromia region. Labor is induced if medically or obstetrically indicated. For clients with unfavorable cervix except for those with premature rupture of membranes, cervical ripening is done using Foley catheter for most of the clients; which is inserted in to the internal cervical Os and inflated with saline and traction applied and spontaneous expulsion is allowed. For some patients cervical ripening is done using Dinoprostone 3mg vaginally up to three doses. Induction of labor is usually started at 6-9AM. Oxytocin is used for induction of labor and the dosage is according to the national guideline protocol. (9)

1.2 Statement of the problem

Induction of labor is best undertaken when continuing the pregnancy is thought to be associated with greater maternal or fetal risk than intervention to deliver the pregnancy, and there is no contraindication to vaginal birth. (10) It has potentials for preventing maternal complications and improving pregnancy outcome. Beyond 41 weeks gestation, the number of routine induction of labor needed to prevent one fetal or neonatal death decreases constantly. (11)

It is one of the most commonly performed obstetrical procedures in the United States. Between 1990 and 2011, the overall frequency of labor induction more than doubled, rising from 9.5 to 23.2 percent. (12) Data from the WHO Global Survey on Maternal and Perinatal Health, which included 373 health-care facilities in 24 countries and nearly 300 000 deliveries, showed that 9.6% of the deliveries involved labor induction. Overall, the survey found that facilities in African countries tended to have lower rates of induction of labor (lowest: Niger, 1.4%) compared with Asian and Latin American countries (highest: Sri Lanka, 35.5%). (13) Study done in Ethiopian teaching hospitals showed the rate of labor induction in term and post term pregnancies to be 4%. This study showed a high rate of cesarean section and one of the justifications given was unripened cervix at the initiation of induction. (8)

As a referral hospital St. Paul accepts a significant number of high risk mothers including those who need labor induction, and in the current setup there is lack of data as the previous study done in this setup only included term and post term pregnancies and those with unripened cervix. This study would help us determine the magnitude of success of labor induction and would also help us to identify determinants and modifiable factors would guide us on counseling and decision.

1.3. Significance of the study

Between 1990 and 2011, the overall frequency of labor induction approximately doubled in the United States. (12) The increasing use of labor induction has been supported by the expansion of medical indications for delivery before the onset of spontaneous labor. Other contributing factors include readily availability of effective cervical ripeneres, medico legal issues, patient demand and financial gain. (2)

Africa has the highest maternal mortality as well as the highest stillbirth and Perinatal mortality rates. Efforts aimed at achieving the health related MDGs should focus on increasing access to effective interventions and on improving quality of health care. In this context, utilization of induction of labor within the African sub-region deserves closer scrutiny. (14, 15)

The results of this study will help us determine the success of labor induction and its specific determinants in our setup. As there is only one study done in Ethiopia to determine the success of induction and though the same protocol was used as the one which is being used currently, there was no uniform cervical ripening method used and even induction was started on unripened cervix which is stated as one reason which decreased the success. Comparing it with previous results will help us to evaluate the efficacy of use of Foley catheter which we mainly use as a cervical ripening agent.

Comparing it with other setups will also help us evaluate the efficacy of our peculiar oxytocin regimen. In addition, it will also help us improve modifiable factors like the time we give to declare failed induction. It also helps us for patient counseling and decision making purpose.

2. Literature review

2.1. Rate of labor induction

Between 1990 and 2010, the overall frequency of labor induction more than doubled, rising from 9.5 to 23.4 percent in the United states (12). Data from the WHO Global Survey on Maternal and Perinatal Health, which included 373 health-care facilities in 24 countries and nearly 300 000 deliveries, showed that 9.6% of the deliveries involved labor induction. Average rate of induction of labor in Africa was 4.4% with a range of 1.4 – 6.8%. Overall, the survey found that facilities in African countries tended to have lower rates of induction of labor (lowest: Niger, 1.4%) compared with Asian and Latin American countries (highest: Sri Lanka, 35.5%). (13) a study done in two teaching hospitals in Ethiopia showed the rate of labor induction in term and post term pregnancies to be 4%. (8)

2.2. Indication for induction

Induction of labor should be undertaken when the benefits of delivery to either mother or fetus outweigh the risks of pregnancy continuation. (10) Hypertensive disorders of pregnancy, Maternal medical conditions, Premature rupture of membranes, Abruptio placentae Fetal compromise or demise are some of the accepted indications for labor induction. (1)

In the 2005 WHO global survey database, Pre-labor rupture of membranes was the commonest indication for induction of labor in South America (28.9%). (16) In a secondary analysis of a global study done to assess the unmet need for induction of labor in Africa, the main indications were premature rupture of membranes (25.3%) and elective induction. (17) This contrasts with

the experience in the United States where hypertensive disorders of pregnancy constitute commonest indications for induction of labor. (18)

In a study done in three teaching hospitals in Addis Ababa, Ethiopia, five hundred fifty-two women induced at term and post term (55.8% nulliparas and 44.2% multiparas). The first three indications for induction were post term, term premature rupture of fetal membranes and hypertension. (8)

2.3 success rate of labor induction

In a study done in Australia which assessed birth outcomes and induction of labor success which included 403,060 normotensive and 44,498 hypertensive women vaginal delivery rates were 69.1% and 66.2% respectively. (19) In Another study done in the UK vaginal delivery occurred in 484 (80.1%) induced women and this was within 24 h of induction in 388 (64.2%), Cesarean section was performed in 120 (19.9%). (20) A secondary analysis of a randomized controlled trial done at the University of Alabama at Birmingham evaluated maternal and Perinatal outcomes in women undergoing labor induction with unfavorable cervix. The overall vaginal delivery rate was 63.2%. (21)

In a South American Analysis of the 2005 WHO global survey database, Of the 97,095 deliveries included, 11 077 (11.4%) were induced, the success rate of vaginal delivery was 70.4%. (16) In a retrospective study done in Karimabad, Pakistan 18% of women who underwent induction of labor failed to deliver vaginally. (22) Another study done in Dr. Congo from Jan 01, 2006 until Dec. 31, 2010 showed that vaginal delivery occurred in 66.9% of women and C/S was done for 29.6%. (23)

In a study done in two teaching hospitals in Addis Ababa Ethiopia by Yifru *et. al* Five hundred fifty two women induced at term and post term Spontaneous vertex delivery (46.4%), caesarean section for failed induction (28.4%) and fetal distress (9.6%) were the top modes of delivery. (8)

2.4. Factors associated with successful induction

The factors that predict success of induction include favorable bishop score (>8), vertex presentation of the fetus, and multiparous patients without prior uterine scar. (2) In a retrospective study done in Karimabad which included 328 nulliparous women, nulliparity, poor Bishop Score and prolonged latent phase had strongest association with failed Induction of Labor. Macrosomia, gestation age, bad obstetric history and pre labor rupture of membranes were other significant risk factors for emergency caesarean sections in induction of labor. (22)

A study of 4635 spontaneous and 2647 induced labors in nulliparous women at term reported the cesarean delivery rates were almost doubled for induced labors with Bishop scores <5 versus ≥ 5 , 32 versus 18 percent. (24) Because pre-labor cervical status highly correlates with the inducibility of labor, a variety of pharmacological and mechanical methods have been developed to effect cervical change and prepare unripe cervixes for labor induction. (25)

Prolongation of time of oxytocin administration after membrane rupture is recommended by different studies to increase the rate of vaginal delivery; A prospective study showed that By requiring a minimum of 12 hours of oxytocin after membrane rupture before failed labor induction could be diagnosed, many nulliparas who remained in the latent phase at 6 and 9 hours had safe vaginal deliveries, and failed labor induction was eliminated as an indication for

cesarean in parous women.(26) Another study showed that a latent phase of as long as 18 hours during induction of labor in nulliparous women allows the majority of these women to achieve a vaginal delivery without being subject to a significantly increased risk of significant maternal or neonatal morbidity.(27) A secondary analysis of a randomized multicenter trial showed that almost 40% of the women who remained in the latent phase after 12 hours of oxytocin and membrane rupture were delivered vaginally. Therefore, it is reasonable to avoid deeming labor induction a failure in the latent phase until oxytocin has been administered for at least 12 hours after membrane rupture. (21)

3. Objective

3.1 General objective-

To determine the success of labor induction and its determinants in St. Paul's hospital millennium medical college.

3.2 Specific objectives

- To determine the success rate of labor induction
- To determine the determinants for the success of labor induction
- To identify the common indications for induction of labor in St. Paul's hospital

4. Methodology

4.1. Study area and period

The study was conducted in St. Paul's hospital which is one of the federal hospitals located in Addis Ababa capital city of Ethiopia. It is a hospital with highest delivery rates in Ethiopia in the past one year. At St. Paul's hospital labor is induced if medically or obstetrically indicated. oxytocin is used for labor induction and dose of 5mIu/min. for primigravida and 2.5mIu/min for multigravida is used and dose escalated accordingly every 20 minutes. Data was collected from July 1, 2016 till Dec 17, 2016.

4.2. Study design

Hospital based cross sectional study was conducted to determine the success rate of labor induction and its determinants. The maternal and Perinatal outcome was also assessed.

4.3. Population

4.3.1. Source population

Women who come to St. Paul's hospital to receive delivery service during the study period.

4.3.2. Study population

Women who underwent labor induction in St. Paul's hospital during the study period for the different obstetric or medical indications according to the Ethiopian national protocol.

4.4. Inclusion and exclusion criteria

Inclusion criteria

Women eligible for induction as per the national protocol and who were induced.

Exclusion criteria

Non vertex presentation detected after the start of the labor induction

4.5. Sample size determination and sampling technique

5.5.1. Sample size

Sample size was determined using a single population proportion formula by taking $P=0.57\%$. The vaginal delivery rate in a previous study done by Yifru and colleagues in two teaching hospitals in Addis including SPHMMC. (9)

$$n = \frac{(Z_{\alpha/2})^2 P (1-P)}{d^2} = \frac{(1.96)^2 (0.43) (1-0.43)}{(0.05)^2} = 376$$

Where:

n =the required sample size

p =the proportion of women with successful induction

$Z_{\alpha/2}$ =the critical value at 95% confidence level of certainty (1.96)

d =the margin of error between the sample and the population 5%.

- With 10% non-response rate, the sample size was 413.

4.5.2. Sampling technique/procedure

Quota sampling was used and women undergoing labor induction were consecutively included in the study during the study period till the required sample size is met. Those who did not fulfill the inclusion criteria were excluded from the study.

4.6. Data collection procedure and instrument

Structured questionnaire assessing sociodemographic characteristics, obstetric factors, mode of delivery and the maternal and neonatal outcomes were prepared in English and the consent form was translated to Amharic language. Questionnaire were pretested on 20 women (5% of the calculated sample size) at Yekatit 12 hospital which is an affiliate hospital before the study period and appropriate modification applied. Data was collected by trained year 2 residents working in the labor ward.

4.7. Data quality control

All filled questionnaires were checked for completeness, accuracy, and consistency by the principal investigator. Necessary corrections were made by cross checking with the patients' chart. Supervision by the principal investigator throughout the data collection was carried out.

4.8. Data processing and analysis

Data was entered in to SPSS statistical package version 20. Coding of individual questionnaires was checked before data entry in to the software. Further, data cleaning was performed to check for outliers, missed values and any inconsistencies before the data was analyzed using the software.

Descriptive statistics were used to characterize the dependant and independent variables.

Results presented as number, percentage, mean $\pm$ SD in tables, bar charts, error bars and survival curves. comparison of the obstetric factors with parity was made using two sampled t-test for continuous variables and paired t test was used to evaluate the change of bishop score before and after cervical ripening.

The association between mode of delivery and possible predictors was checked using bivariate analysis and for those variables which were found to have P values less than 0.2 multivariate regression analysis was done a P value of <0.05 was regarded as statistically significant.

4.9. Ethical consideration

Ethical clearance & permission letter was obtained from the Institutional Review Board (IRB) of St. Paul's hospital millennium medical college (SPHMMC). Aim of the study was explained and written consent taken from the study subjects. The privacy of the client and confidentiality of the information was maintained.

4.10. Variables

4.10.1. Dependant variables

- Success of induction
- Failed induction

4.10.2 Independent variables

- | | |
|----------------------------|-------------------------|
| ▪ Bishop score | ▪ Maternal age |
| ▪ Parity | ▪ Weight of the neonate |
| ▪ Indication for induction | ▪ Duration of ROM |
| ▪ Gestational age | |

4.11. Operational definition

Adequate uterine contraction- Uterine contraction of at least 3 in 10 minutes lasting for at least 40 minutes.

Cesarean delivery for other indications- when cesarean section is done for indications other than failed induction.

Failed induction- When patients fail to achieve active labor and undergo cesarean section for the indication of failed induction.

Favorable bishop- Bishop score nine and above

Intermediate Bishop- Bishop score five to eight

Successful induction- When vaginal delivery is achieved after induction either spontaneously or assisted with instrument.

SVD- vaginal delivery achieved after induction of labor without assistance with instrument

unfavorable Bishop- bishop score four and less.

5. Results

From July 1- Dec. 17 2016 the total number of deliveries was 4598 and there were 413 cases of labor induction with Oxytocin and the rate of labor induction was 8.98%. Of the total of 413 cases 11 were excluded from analysis due to incompleteness and inconsistency and 402 were analyzed.

5.1. Sociodemographic characteristics of the study participants

Majority 190(47.3%) of the women who underwent labor induction at St. Paul's hospital were Orthodox by religion and Amhara 148(37.4%) by Ethnicity. Majority of them are married 390(97.7%) and housewife 220(55%). One hundred forty-two (35.6%) have reached secondary school or above. (table 1)

Table 1. Sociodemographic characteristics of mothers who underwent induction of labor at SPHMMC from July 1- Dec. 17 2016.

Variables	Number	Percentage
Religion		
Orthodox	190	47.3
Muslim	146	36.3
Protestant	64	15.9
Catholic	2	0.5
Ethnicity		
Amhara	148	37.4
Oromo	128	31.9
Gurage	84	20.9
Tigre	10	2.5
Other	31	7.7
Marital status		
Married	390	97.7
Single	4	1.0
Divorced	3	0.8
Widowed	2	0.5
Educational status		
No formal education	94	23.6
Primary school	163	40.9
Secondary school	96	24.1
Above secondary school	46	11.5
Occupation		
Government employee	73	18.3
Merchant	70	17.5
Daily laborer	8	2.0
House wife	220	55.0
Farmer	7	1.8
Other	22	5.5

5.2 Preinduction obstetric conditions of the study participants

The mean age of the women who underwent labor induction was 27.34 ± 5.08 . Of the 402 women who underwent induction of labor 240(59.7%) were nulliparous. For 307(76.4%) of the women the gestational age was known either from LNMP or an early milestone and the mean gestational age was 38.27 ± 5.08 weeks, of these majority 207(67.4%) were term followed by late preterm 54(17.6%). For those the gestational age in weeks is not known it was grossly assessed in months and the mean gestational age was found to be 8.68 ± 0.52 months. (table 2)

The commonest indication for induction for both nulliparous and multiparous women is pregnancy induced hypertension occurring in 57.7% followed by Premature rupture of membranes (20.9%) and oligohydramnios (13.2%). (table 2)

Majority 281(69.9%) of the women had unfavorable bishop score and only 12(3%) had favorable bishop score at presentation. Two Hundred eighty-three (70.4%) underwent cervical ripening procedure and for majority 269(95.1%) of them Foley catheter was used. At the start of the induction majority (60.9%) of the women had intermediate bishop score and 24.6% of them had favorable bishop score, the bishop score of 14.4% of women was unfavorable. The mean bishop score before and after cervical ripening was 3.80 and 7.62 respectively which has increased significantly($p < 0.001$) and it was found to be significantly higher in multiparous than nulliparous women both before and after cervical ripening. ($p < 0.001$) (table 2)

Table 2. Preinduction obstetric conditions by parity of mothers who underwent induction of labor in SPHMMC from July 1- Dec. 17 2016.

variables	Nullipara 240(59.7)	Multipara 162(40.3)	Total 402(100%)	P value
Maternal age(mean± SD)	25.25(4.20)	30.43(4.68)	27.34(5.08)	<0.001
gestational age				
In weeks(mean±SD) (307)	38.28(3.21)	38.24(2.60)	38.27(2.98)	0.91
In months(mean± SD)-(95)	8.72(0.48)	8.64(0.58)	8.68(0.52)	0.46
Indication for induction				
PIH	135(56.2)	97(59.9)	232(57.7)	0.47
PROM	56(23.3)	28(17.3)	84(20.9)	0.143
Post term	25(6.2)	7(1.7)	32(8.0)	0.027
Oligohydraminos	34(14.2)	19(11.7)	53(13.2)	0.478
APH	18(7.5)	18(11.1)	36(9.0)	0.214
IUGR	14(5.8)	7(4.3)	21(5.2)	0.504
Other	24(10.0)	20(12.3)	44(10.9)	0.460
Initial bishop score(mean ±SD	3.47(2.00)	4.30(2.12)	3.80(2.09)	<0.001
Bishop score category				0.011
Unfavorable	178(74.2)	103(63.6)	281(69.9)	
intermediate	59(24.6)	50(30.9)	109(27.1)	
favorable	3(1.2)	9(5.6)	12(3.0)	
Use of cervicalripening				0.121
Yes	162(67.5)	121(74.7)	283(70.4)	
Methode used				
Foley cathether	156(96.3)	113(93.4)	269(95.1)	
dinoprostone	6(3.7)	8(6.6)	14(4.9)	
no	78(32.5)	41(25.3)	119(29.6)	
Bishop score after cervical ripening(mean ±SD)	7.36(1.68)	7.97(1.43)	7.62(1.61)	0.002
Bishop score at the start of induction(mean ±SD)	6.52(2.15)	7.52(1.88)	6.92(2.10)	<0.001
Bishop score at the start of induction category				<0.001
Unfavorable	45(18.8)	13(8.0)	58(14.4)	
Intermediate	154(64.9)	91(56.2)	245(60.9)	
favorable	41(17.1)	58(35.8)	99(24.6)	

5.3 Outcomes of labor induction of the study participants

The mean maximum oxytocin dose used was 59mIU/min for nulliparas and 27.52mIU/min for multiparas. Adequate uterine contraction was attained in 327(81.3%) of the women who underwent labor induction; There was no significant difference in the time required to achieve adequate uterine contraction among nulliparas and multiparas the mean time being 3.72hours. (table 3) The rest 18.7% of the women failed to attain adequate uterine contraction and significant number of them were nulliparas($P=0.001$). (table 3)

As it is shown in table 3, 270(67.16) entered in to active labor and 246(61.19%) delivered vaginally of these 16(3.98%) were instrumental deliveries; 10(2.5) vacuum deliveries and 6(1.5) forceps deliveries. The mean induction to delivery interval was 8.77hrs and 6.72hrs for nulliparas and multiparas respectively, it was significantly higher for nulliparas ($p<0.001$). (table 3) One Hundred fifty four (38.3%) of the women who were induced underwent cesarean section commonest indication for cesarean section was failed induction 69(44.8%) followed by Non reassuring fetal heart rate pattern 66(42.9%). The data showed that 69(17.1%) of the inductions end up with failed induction. Again failed induction was significantly associated with nulliparity ($p=0.048$). (table 3) The mean duration of rupture of membrane for those who underwent cesarean section for failed induction (excluding those who came with rupture of membrane) was 5.21 ± 3.43 hrs.

Table 3. Induction of labor outcomes by parity of mothers who underwent induction of labor in SPHMMC from July 1- Dec. 17 2016. (n= 402)

	nulliparas	Multiparas	total	P value
	240(59.7)	162(40.3)	402(100%)	
Maximum dose of oxytocin used	59.00(17.54)	27.52(7.74)	46.31(21.13)	<0.001
Adequate contractions achieved				0.001
Yes	183(76.2)	144(88.9)	327(81.3)	
No	57(23.8)	18(11.1)	75(18.7)	
Duration to adequate contraction	3.62(3.35)	3.85(5.17)	3.72(4.25)	0.612
Induction to delivery interval	8.77(3.76)	6.72(3.39)	7.95(3.75)	<0.001
Active labor achieved	143(59.6)	127(78.4)	270(67.16)	<0.001
Mode of delivery				
vaginal	129(53.75)	117(72.22)	246(61.19)	<0.001
SVD	117(48.8)	113(69.8)	230(57.2)	
vacuum	9(3.8)	1(0.6)	10(2.5)	
Forceps	3(1.2)	3(1.9)	6(1.5)	
Cesarean section	110(45.8)	44(27.2)	154(38.3)	
Indication for CS				0.048
Failed induction	55(50.0)	14(31.8)	69(44.8)	
Fetal distress	44(40.0)	22(50.0)	66(42.9)	
MSAF	7(6.4)	2(4.5)	9(5.8)	
CDP	2(1.8)	1(2.3)	3(1.9)	
other	2(1.8)	5(11.4)	7(4.5)	
Laparotomy	1(.4)	1(.6)	2(0.5)	
Induction to delivery interval	8.77(3.76)	6.72(3.39)	7.95(3.75)	<.001
mean±SD				

The mean induction to delivery interval was 7.95 hr. and it was significantly shorter in multiparas. It was also significantly shorter for women who deliver vaginally compared to those who delivered by cesarean section (7.22 versus 9.05). (fig 2& 3)

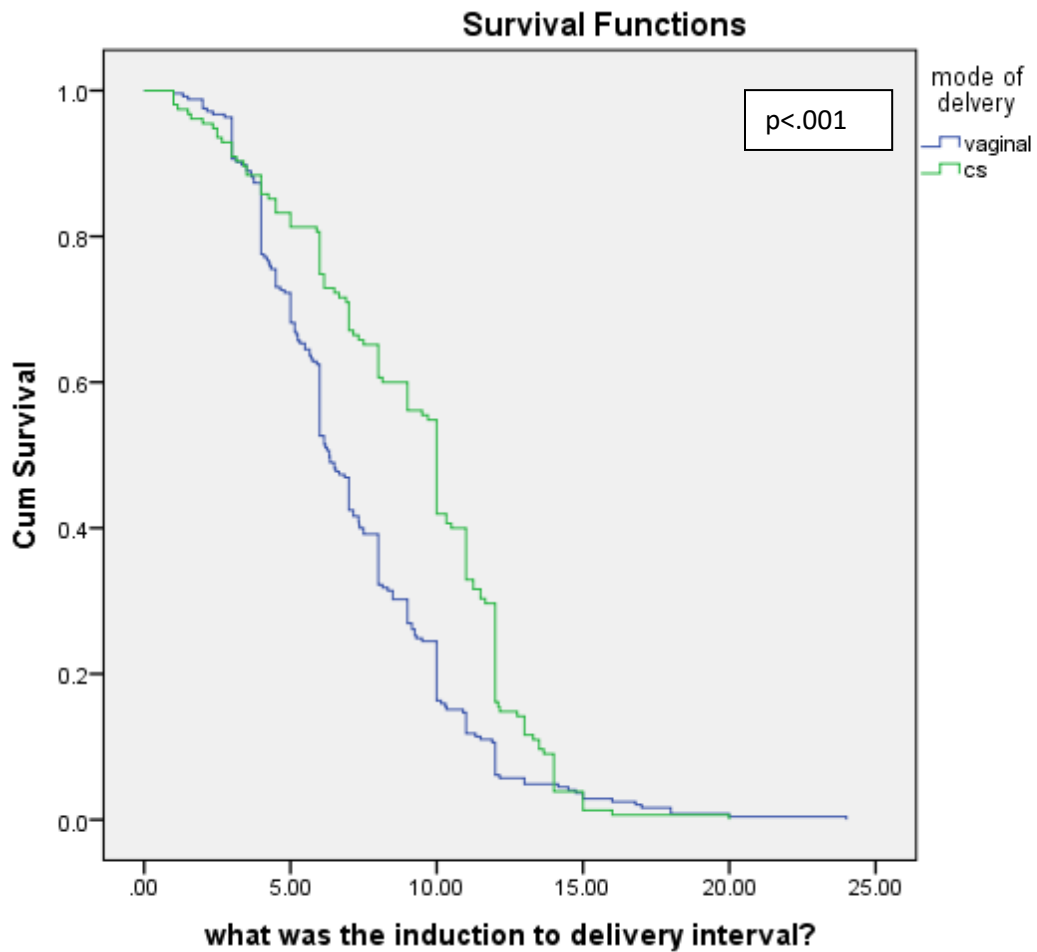


Figure 1. Induction to delivery interval for vaginal and cesarean delivery of mothers who underwent induction of labor in SPHMMC from July 1- Dec. 17 , 2016.

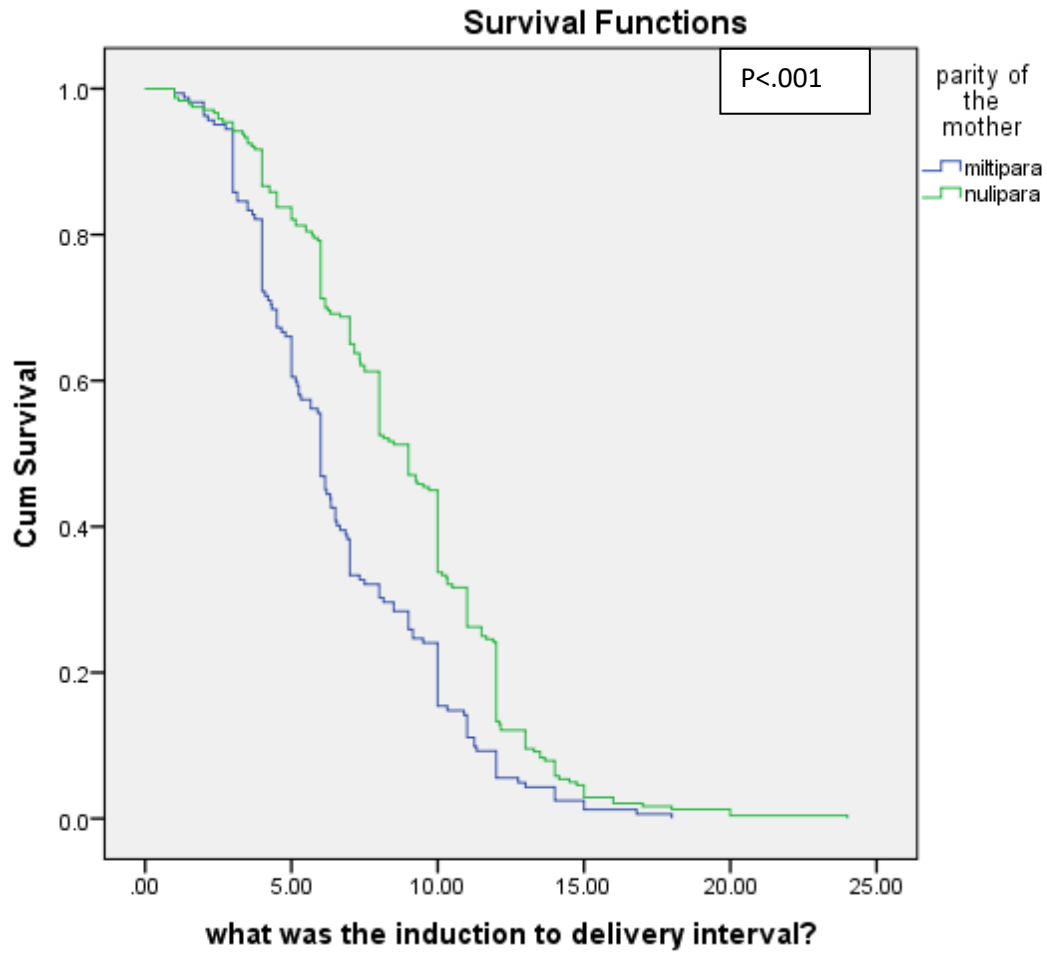


Figure 2. Induction to delivery interval among nulliparous and multiparous women of mothers who underwent induction of labor in SPHMMC from July 1- Dec. 17 2016.

5.4 Factors affecting mode of delivery of the study participants

Among those who underwent cesarean section and who delivered vaginally there was no significant difference in maternal age, gestational age and the time that took them to attain adequate uterine contraction. (table 4) But there was a significant difference of parity($p<0.001$) and the bishop score just before the start of induction($p<0.001$). The induction to delivery interval was also longer in those who delivered by cesarean section 9.05 versus 7.22hrs respectively($p<0.001$). (table 4)

The mean induction to delivery interval for those who underwent cesarean section for failed induction was 11.55hrs (table 4). The mean duration of rupture of membrane for those who underwent cesarean section for failed induction (excluding those who came with rupture of membrane) was 5.21 ± 3.43 hrs. Women with failed induction had significantly lower mean initial bishop score. ($p=0.008$) (fig 3).

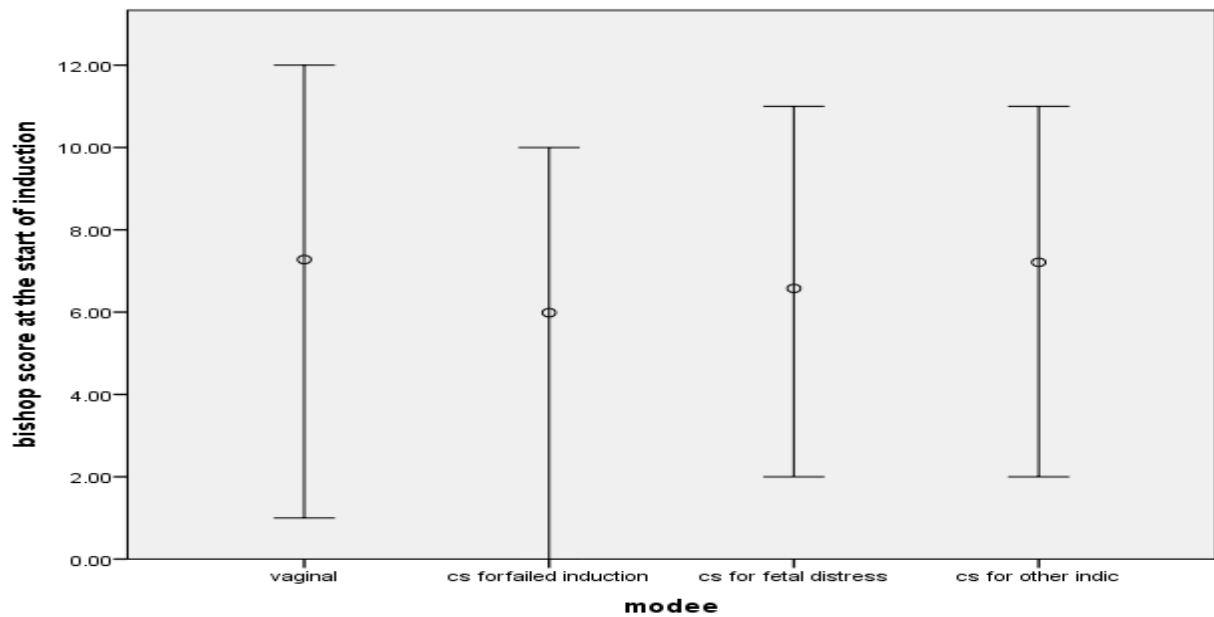


Figure 3. Bishop score at the start of induction versus mode of delivery of mothers who underwent induction of labor in SPHMMC from July 1- Dec. 17, 2016.

Table 4. Obstetric factors in relation to mode of delivery of mothers who underwent induction of labor in SPHMMC from July 1- Dec. 17 2016. (n= 400)

****Two patients with uterine rupture excluded from this analysis***

	Cesarean delivery 154(38.5)	Vaginal delivery 246(61.5)	Total* 400	P value
age	26.88(4.98)	27.64(5.12)	27.35(5.07)	0.146
parity				<0.001
Nulliparas	110(46.4)	129(53.6)	239(100)	
Multiparas	44(27.3)	117(72.7)	161(100)	
gestational age				
In weeks (mean±SD)	38.3(2.90)	38.22(3.04)	38.25(2.98)	0.816
In months (mean±SD)	8.66(0.64)	8.69(0.46)	8.68(.520)	0.745
Indication for induction				
PIH	97(34.3)	134(65.7)	231(100)	0.120
PROM	26(31.3)	57(68.7)	83(100)	0.119
Post term	16(50.0)	16(50.0)	32(100)	0.173
Oligohydraminos	18(34.0)	35(66.0)	53(100)	0.442
APH	12(33.3)	24(66.7)	36(100)	0.484
IUGR	9(42.9)	12(57.1)	21(100)	0.691
other	10(22.7)	34(77.27)	44(100)	0.021
Bishop score at the start of induction(mean±SD)	6.41(2.15)	7.27(1.99)	6.94(2.09)	<0.001
Bishop score at the start of induction				0.001
Unfavorable	31(54.38)	26(45.62)	57(100)	
Intermediate	99(40.57)	145(59.43)	244(100)	
favorable	24(25.20)	75(75.80)	99(100)	
Duration till adequate contraction(mean±SD)	3.52(1.88)	3.13(2.01)	3.22(1.98)	0.127
Induction to del interval(mean±SD)	9.05(3.78)	7.22(3.56)	7.93(3.75)	<0.001

Variables with $P < 0.2$ were included in Multivariate analysis and it showed multiparity and higher bishop score at the start of labor induction to be a strong predictors of vaginal delivery. Multiparous women were likely to have successful induction around two fold of Nulliparas (1.97). For each point increase in bishop score there is 1.4 times higher likelihood of delivering vaginally. Of the indications for induction those with PROM as an indication for induction are likely to deliver vaginally. (table 5)

Table 5. Multivariate analysis of factors associated with successful induction

	Successful induction		COR(95% CI)	AOR(95% CI)
	yes	no		
Age(mean SD)	27.64(5.11)	26.88(5.00)	1.030(0.989,1.073)	0.987(0.940,1.037)
parity				
multipara	117	44	2.267(1.475,3.485)	1.969(1.167,3.323)
nullipara	129	110	1	1
PIH				
Yes	135	96	0.735(0.487,1.109)	0.885(0.515,1.520)
No	111	58	1	1
PROM				
Yes	57	26	1.485(0.887,2.486)	3.811(1.727,8.362)
No	189	128	1	1
Post term				
Yes	16	16	0.600(0.291,1.238)	0.541(0.235,1.243)
no	230	138	1	1
Bishop score at the start of induction	7.28(1.99)	6.39(2.15)	1.230(1.112,1.359)	1.408(1.230,1.612)

5.5 maternal complications and neonatal outcomes

The mean neonatal weight was 2664±677grams. There was no significant neonatal weight difference among those who underwent cesarean section and vaginal delivery. The mean neonatal APGAR score was 7.05 and 8.09 at the 1st and 5th min respectively. Ninety-nine (26.3%) of the neonates were sent to NICU and the commonest reason for referral was respiratory distress secondary to HMD followed by suspected neonatal sepsis. (table5)

Uterine atony was reported in 6(1.49%) patients and uterine rupture occurred in 2(0.5%) patients.

Table 6. Neonatal outcomes and complications of mothers who underwent induction of labor in SPHMMC from July 1- Dec. 17 2016.

	Number(percentage)	mean±SD
Weight		2664(677)
1st min APGAR(mean±SD)		7.05(1.99)
5th min APGAR (mean±SD)		8.09(2.27)
NICU referral		
Yes	99(24.6)	
No	303(75.4)	
Reason for referral		
HMD	42(42.4)	
EONS	26(26.3)	
MAS	8(8.1)	
PNA	1(1.0)	
OTHER	22(22.2)	
Maternal complication	9(2.20)	
Uterine atony	6(1.49)	
Uterine rupture	2(0.5)	
Other	1(0.25)	

6. Discussion

In this study the commonest indication for induction of labor was found to be hypertensive disorders of pregnancy which is 57.1% with no significant difference among nulliparas and multiparas, this was consistent with study done in DR. Congo(23) but it is not consistent with studies done in Africa and Latin American countries by the WHO in which Premature rupture of membranes(PROM) is stated as the commonest indication.(13) This could be explained by the fact that mothers with PROM are more likely to be referred to lower level facilities with the hypertensive women being admitted to this hospital.

Mechanical methods of cervical ripening had proven to be effective cervical ripeners in different studies; one study showed mean change in bishop score of 3.3 to 5.3 with the use of Balloon catheter (28); in this study Balloon catheter was used in 95% of women undergoing cervical ripening and the bishop score before and after ripening was 3.8 and 7.62 respectively($p < 0.001$).

it is well known that multiparous women have higher success rate of labor induction, in this study also it was found multiparous women were found to be associated with 1.97 fold increased rate of successful induction after controlling confounders.

Higher Bishop score is also one of the predictors of successful labor induction. A study which included 2647 nulliparous women induced at term reported the cesarean delivery rates were almost doubled for induced labors with Bishop scores < 5 versus ≥ 5 , 32 versus 18 percent. (27) This was also observed in this study in which 74.7% of those with favorable bishop delivered vaginally while only 45.6% of those who had unfavorable bishop score at the start of induction managed to deliver vaginally. Of those who delivered by cesarean section for failed induction 58.1% had unfavorable bishop score.

The overall rate of vaginal delivery in this study was 61.2% which is lesser than other studies especially done in the western setup. A study done in the UK showed vaginal delivery occurred in 484 (80.1%) induced women and this was within 24 h of induction.(20) In a study which included 509 women by requiring a minimum of 12 hours of oxytocin after membrane rupture before failed labor induction could be diagnosed, many nulliparas who remained in the latent phase at 6 and 9 hours had safe vaginal deliveries, and failed labor induction was eliminated as an indication for cesarean in parous women (26). In a secondary analysis of a multicenter randomized clinical trial almost 40% of the women who remained in the latent phase after 12 hours of Oxytocin and membrane rupture were delivered vaginally and the study concluded, it is reasonable to avoid deeming labor induction a failure in the latent phase until oxytocin has been administered for at least 12 hours after membrane rupture.(21) In this study the mean duration till declaration of failed induction was 11.55hrs and the mean duration of rupture of membrane for those who underwent cesarean section for failed induction (excluding those who came with rupture of membrane) was 5.21 ± 3.43 hrs which is lesser and it could be one of the factors contributing to lower success rate of labor induction in this study.

The rate of vaginal delivery was higher than in a study done in two large teaching hospitals in Ethiopia in 2007 which showed the rate of vaginal delivery to be 56.7%. The vaginal delivery rate in this study is higher possibly due to the lesser proportion of women who began the induction with unfavorable bishop. Also the rate of cesarean section for failed induction is lower in this study which is 17.1% than the previous Ethiopian study in which 28.4% of the induced women underwent cesarean section for failed induction. the percentage of women who achieved

adequate contraction is comparable being 81.3% in this study and 84.1% and 84.8% for nulliparas and multiparas respectively in the previous Ethiopian study. (9)

Of the indications for induction those with PROM as an indication for induction are likely to deliver vaginally, preeclampsia which is an indication for induction for majority of the women didn't show any significant association with the mode of delivery but this study is not powered enough to conclude on the significance of these variables.

7. Limitations

- Only adequacy of contractions was assessed and those with hyper stimulation were not included in the study
- The rate of complications like PPH secondary to uterine atony may have been overlooked by the delivery attendant and all of them were not mentioned on the patient chart which could underestimate such cases.

8. Conclusion

- The commonest indication for labor induction was pregnancy induced hypertension.
- Cervical ripening was made with Foley catheter for most of the patients. There was significant change of bishop score before and after cervical ripening.
- There was significant difference in the bishop score, mode of delivery and induction to delivery interval among nulliparas and multiparas.
- The rate of successful induction was 61.4% and was lower than studies done in other setups.
- Factors significantly associated with success of induction were multiparity, higher bishop before the initiation of induction.

9. Recommendation

- Induction of labor should be made as much as possible after proper cervical ripening.
- Time to declare failed induction should be reconsidered to be prolonged.
- Labor follow-up should be appropriate to prevent adverse complications like uterine rupture.

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Annexes

Annex I. Consent form

Questionnaire designed to determine the success rate of labor induction and its determinants at St. pauls hospital. SPHMMC Addis Ababa, Ethiopia

Questionnaire no_____

individual information sheet

This is a research being conducted in Saint Paul's Hospital Millennium Medical College. We are studying the success of labor induction and its determinants. The aim of the study is to measure the proportion of women who deliver vaginally. The candidates for this study are clients who came to the delivery service and for whom labor is induced.

The data will be collected via chart review and some interview questions will be forwarded to you. Whatever information you provide and your test result will be kept strictly confidential and is to be used only for the purpose of this study. Your participation is voluntary.

Are you willing to participate?

Yes, I agree.....

Annex II: Consent (Amharic version)

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Annex III: Questionnaires

I) MRN_____

II) Socio demographic status

1. Age_____

2. Religion

a. Orthodox

b. Muslim

c. Protestant

d. Catholic

e. Other -----

3. Ethnicity

a. Amhara

b. Oromo

c. Gurage

d. Tigre

e. Other-----

4. Marital status

a. Married

b. Single

c. Divorced

d. Widowed

5. Educational status

a) No formal education

b) Primary school

c) Secondary school

d) Above Secondary school

6. Occupation

a) Government Employee

b) Merchant

c) Daily laborer

d) House wife

e) Farmer

f) Other

III- obstetric factor

7. Parity

- a. nullipara b. multipara

8. gestational age_____

9. Indication for induction (multiple responses allowed)

- a. PIH
- b. PROM
- c. Post term
- d. Oligohydraminos
- e. APH
- f. Others, specify_____

10. Initial Bishop score_____

11. Is cervical ripening procedure used?

- Yes
- No

12. If yes to Q 11 the method used is

- a. Foley cathether b. Prostaglandin E2

13. If yes to Q. 11 bishop score after the cervical ripening_____

14. Duration of ROM (in hr:minute) _____

15. Is adequate uterine contraction achieved?

- a. Yes b. no

16. if yes to Q. no 15, Duration till adequate uterine contraction (in hr:minute)_____

17. Maximum oxytocin dose used _____

18. Mode of delivery

- a. Cesarean section c. Forceps e. Other, specify _____
- b. SVD d. Vacuum

19. If cesarean section for Q 18, indication

- | | |
|----------------------------|--------------|
| a. Failed induction | d. CPD |
| b. Fetal distress | e. Other |
| c. Meconium stained liquor | specify_____ |

20. If cesarean section for Q 18 was active labor achieved?

- | | |
|--------|-------|
| a. Yes | b. No |
|--------|-------|

21. Induction to delivery interval (hr:min)_____

III- outcome

22. Weight(gm)_____

23. 1st minute APGAR score_____

24. 5th min APGAR_____

25. NICU referral

- | | |
|--------|-------|
| a. Yes | b. No |
|--------|-------|

26. Reason for referral

- | | |
|------------------------------------|------------------------|
| a. Hyaline membrane disease | d. Perinatal asphyxia |
| b. Early onset neonatal sepsis | e. Other; specify_____ |
| c. Meconium aspiration
syndrome | |

27. Maternal complications

- | |
|------------------------|
| a. Uterine atony |
| b. Uterine rupture |
| c. Other; specify_____ |

Declaration

I the undersigned declare that this thesis is my original work in partial fulfillment of the requirement for the postgraduates' study in Ob-Ggy. I also declare that it has never been presented in this or any other university and that all resources and materials used in this thesis have been duly acknowledged.

Dr. Nebayt Tadlo

Signature _____

Date of submission- Mar.13, 2017

This thesis has been submitted for examination with my approval as an advisor.

Advisor Name- Dr. Delayehu Bekele

Signature_____

Date of submission- Mar. 13, 2017