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Evaluation of Labor Induction Versus Spontaneous Labor Outcomes at Kigali University Teaching Hospital and Muhima Hospital

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ABSTRACT

BACKGROUND: Labor induction may be associated with risks such as higher rates of fetal distress, Newborn Special Care Unit admissions, Cesarean section, and postpartum hemorrhage (PPH) compared to spontaneous labor. Currently, little data is available on these risk rates for resource-limited countries.

This study's main was to evaluate maternal and perinatal outcomes of labor induction versus spontaneous labor in Kigali, Rwanda.

METHODS: A prospective comparative study was conducted at two large referral hospitals in Kigali, Rwanda over a six-month period. Women who met the inclusion criteria of being at term or post-term without any underlying medical or surgical conditions and who were admitted for a scheduled induction of labor or spontaneous labor were included in the study. Women with obstetric complications, abnormal fetal growth, and oligohydramnios were excluded from the study.

RESULTS: There were 1,790 women who met the study criteria. Of these women, 1,543 had a spontaneous labor (86.2%) and 247 were induced (13.8%). Among women admitted for a spontaneous labor, 1,399 (90.67%) delivered vaginally and 144 (9.33%) delivered by Cesarean section. In the induction group, 185 (74.89%) delivered vaginally and 62 (25.11%) delivered by Cesarean section ($p < 0.001$). Postpartum hemorrhage was more common in the induction group (3.2% versus 1.1 %; p=0.008). An Apgar score of <7 after one (1) minute occurred at a rate of 6.9% in the induction group and 4% in the spontaneous labor group ($p = 0.036$). There were no differences in five (5) minute Apgar scores or Newborn Intensive Care Unit admissions between the groups.

CONCLUSIONS: Induction of labor was associated with higher rates of Cesarean section and postpartum hemorrhage. There were also increased rates of low Apgar scores after 1 minute but no difference in neonatal complications. Health care providers should anticipate possible complications when inducing labor and consider the proper selection of candidates. An appropriate setting should always be considered prior to induction.

Keywords: Induction of Labor, Cesarean Section, Rwanda

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INTRODUCTION

Induction of labor (IOL) rates vary widely. The World Health Organization recommends that induction should be performed only in the presence of a clear medical or obstetric indication of induction [1,2].

In high-income countries, such as the United States, the United Kingdom, and Australia, 25% of deliveries at term are induced. However, this rate is generally lower in developing countries and not well documented [3–6]. Data from the WHO Global Survey of seven (7) African countries revealed an induction rate of 4.4%, and induction indicated for a medical condition (like hypertension, diabetes and others) was associated with higher rates of low Apgar scores, Newborn Intensive Care Unit (NICU) admissions, low birth weight, and fresh stillbirths. On the other hand, the Cesarean section rate was found to be reduced in developing countries [7].

IOL's compliance rates in the literature vary widely and are difficult to assess, as most inductions in developing countries are not elective, resulting in the absence of appropriate comparison groups. A study performed at Jima University in Ethiopia, evaluating the outcome of oxytocin induction among term and post-term pregnancies, revealed that the most common indicators of induction were premature rupture of membranes (PROM) (36.6%), hypertensive conditions related to pregnancy (34.3%). Induction of labor for post-term pregnancies only without other associated conditions accounted for (23.2%) of all induction [8]. In this study, 65.0% of the inductions were emergent and the Cesarean Section rate was 34.2%, with 10.7% of them being instrumental deliveries. In 2012, a comparative study of spontaneous and induced labor in India using the modified WHO partograph revealed that the Cesarean section rate was significantly higher in induced labors (20%) compared to spontaneous labors (11.03%). The partograph has been used to give a pictorial overview of labor in a standardized way and has been associated with improved outcomes. There were no significant differences in rates of postpartum hemorrhage (PPH) or neonatal outcomes [9].

Rwanda was not part of the WHO Global Survey, so there is no published data about maternal or neonatal outcomes following IOL in Rwanda, despite it being a common practice. We conducted this study in order to obtain baseline data in Rwanda and to document whether the outcomes are similar to other developing countries. Contrary to other studies cited, this study is unique in that our cohort is a selected group of patients with singleton gestations and no underlying medical, surgical, or obstetrical complications. Thus, there is no increase in the risks of maternal or neonatal complications.

The main objective of this study was to evaluate the maternal and perinatal outcomes of labor induction in the two largest maternity units in Kigali, Rwanda.

METHODS

Study Design: This is a prospective observational study. The study duration was six months from March 2017 to August 2017.

Study Sites: This study was conducted at the University Teaching Hospital of Kigali (CHUK) and the Muhima District Hospital in Kigali, Rwanda. CHUK is the primary teaching and tertiary referral hospital of Rwanda with a maternity unit that performs over 2,000 deliveries per year. Muhima District Hospital is the largest public obstetric hospital in Rwanda and is accessible to a diverse group of patients regardless of their financial status. The hospital also accepts transfers, to reach over 10,000 deliveries annually.

Procedures: Any patients admitted for induction of labor or spontaneous labor that fulfilled the selection criteria were evaluated using the current hospital monitoring protocol. Requirements for inclusion were singleton gestation, vertex (cephalic presentation), and live pregnancies at term (> 37 weeks), with no previous uterine surgery, such as myomectomy, no prior Cesarean Section, and no underlying medical conditions. Patients who were not candidates for vaginal delivery (malpresentation, placenta previa, or vaginal bleeding), had non-reassuring fetal testing before IOL or labor onset, had premature rupture of membranes, oligohydramnios, or growth restriction were excluded. Patients with active malaria or preeclampsia on admission were also excluded. GA (gestational age) was calculated from LMP (last menstrual period) and a 1st trimester ultrasound. If no dates were established, an admission ultrasound was performed. A

questionnaire was used to document the maternal demographics as well as the maternal and neonatal outcomes. The delivery outcomes were recorded from chart review by trained midwives, and the principal investigator verified the information. Neonatal outcomes included Apgar scores and NICU admissions. The study evaluated complications that occurred within the intrapartum and immediate postpartum period (within the first 24 hours after delivery); it did not examine complications that occurred after this time period.

Data collection, management, and analysis: Data entry and analysis were done using SPSS16.0 software. Student t-tests were employed for comparing continuous variables with a normal distribution. Binary logistic regression was used to minimize confounding factors. A p-value of < 0.05 was considered significant.

Ethical clearance: This study received ethical approval from each hospital and the Institutional Research Board of the College of Medicine and Health Sciences at the University of Rwanda.

RESULTS

During the study period, 1,790 women who met the selection criteria were admitted either for spontaneous labor or labor induction. Demographic information and clinical characteristics are shown in Table 1.

Misoprostol was the most common induction method (97.1%), and it was usually administered orally (90.7%). Labor augmentation with oxytocin was documented in 12.1% of participants. Overall, 88.5% of patients had a spontaneous vaginal delivery and 11.5% delivered by cesarean section. Short term maternal complications were uncommon. Other than the Cesarean section, the most common complication was postpartum hemorrhage, which accounted for 1.4% of all study participants.

Third- and fourth-degree lacerations were also uncommon (1.3%). The average hospital stay was less than three (3) days for 91% of patients, and 0.8% of patients had a hospital stay of 7 days or more.

Table 1: Sociodemographic and clinical characteristics

		N	Percentage
Age	<18 years	34	1.9
	18-35 years	1495	83.5
	36-40 years	200	11.2
	≥40 years	61	3.4
BMI	Normal (18.5 – 24.9)	851	47.5
	Overweight (25 – 29.9)	780	43.6
	Obese (≥30)	159	8.9
Parity	Nulliparous	831	46.4
	Primiparous	424	23.7
	Multiparous	535	29.9
Admission Type	Spontaneous Labor	1543	86.2
	Induction	247	13.8
Dating Method	LMP or 1st Trimester Ultrasound	1352	75.5
	Admission Ultrasound	438	24.5
Gestational Age	37-38 week 6 days	321	17.9
	39 weeks to 40 weeks 6 days	982	54.9
	41 weeks and 41 weeks 6 days	336	18.8
	42 weeks	151	8.4

Table 2: Quality of life according to children compared to QoL according to parents

	Spontaneous Labor	IOL	OR (95% CI)	p-value
N	1543	247		
SVD	1399 (90.7%)	185 (74.9%)		
Cesarean section	144 (9.3%)	62 (25.1%)	3.25 (2.32-4.55)	<0.001
Maternal complications				
Postpartum hemorrhage	17 (1.1%)	8 (3.2%)	3.1 (1.3-7.4)	0.008
Third-degree laceration	15 (1.0%)	6 (2.4%)	2.6 (1.0-7.0)	0.048
Uterine rupture	1 (0.1%)	0	2.2 (0.09-54.8)	0.689
ICU admission	0	1 (0.4%)	12.5 (1.12-138.4)	0.031
Blood transfusion	0	1 (0.4%)	12.5 (1.12-138.4)	0.031
Hospital stay				
≤ 1 day	1238 (80.2%)	99 (40.1%)	Ref	
2-3 days	199 (12.9%)	95 (38.5%)	5.97 (4.34-8.21)	<0.001
4-7 days	94 (6.1%)	50 (20.2%)	6.65 (4.46-9.91)	<0.001
≥ 7 days	12 (0.8%)	3 (1.2%)	3.12 (0.86-11.2)	0.081
Neonatal complications				
NICU admission	57 (3.7%)	11 (4.5%)	1.21 (0.62-2.34)	0.564
Immediate neonatal death	1 (0.1%)	0	2.10 (0.08-51.5)	0.651
Apgar <7 at 1 minute	61 (4.0%)	17 (6.9%)	1.79 (1.03-3.12)	0.036
Apgar <7 at 5 minutes	27 (1.7%)	1 (0.4%)	0.23 (0.03-1.68)	0.114

SVD: Spontaneous Vaginal Delivery, N: Number of participants, OR: Odds Ratio, 95% CI: Confidence Interval is standard, Ref: Reference goup.

Short term neonatal complications were also unusual, with only 1.6% of neonates having an Apgar score less than 7. The majority of neonates had a normal birth weight, with only 1.6 % weighing less than 2.5 kg and 4.1% weighing over 4 kg. The NICU admission rate was 3.8%, with one early neonatal death. Comparison of outcomes between the spontaneous labor and induction groups are shown in Table 2. The rate of IOL differed between the two hospitals, with a significantly higher rate of IOL at CHUK (33.8% vs 7.6%, p <0.001). The occurrence of postpartum hemorrhaging, third-degree lacerations, transfusions, ICU admissions, and prolonged hospital stays were significantly higher with IOL. The rate of PPH was higher in IOL (3.2% vs 1.1%, p=0.008). The risk of cesarean section in the induction group was 3.25 times higher than in the spontaneous labor group (25.1% vs 9.3%, p<0.001). As for neonatal outcomes, the only difference was seen in a higher proportion of Apgar scores less than one at one-minute post-delivery for the induction group (4% vs 6.9% p= 0.036). However, other neonatal outcomes, including five-minute Apgar scores, did not show significant differences.

The distribution of outcomes according to the mode of delivery is shown in Table 3. There were no significant differences in maternal complications between delivery types. Significantly longer hospital stays were seen in patients who underwent Cesarean Section. NICU admission was higher in the cesarean section group (10.2% vs.3.0% (OR=3.71; 95% CI 2.16-6.34; p<0.001).

Logistic regression was performed and adjusted to account for confounding variables. Logistic regression is the standard statistical analysis performed when there are concerns for confounding variables. This analysis found a

Table 3: Maternal complications stratified by delivery type

	SVD	Cesarean section	OR (95% CI)	p-value
PPH	25 (1.6%)	0	1.13 (1.11-1.15)	0.07
ICU admission	1 (0.1%)	0	0.88 (0.87-0.90)	0.72
Blood transfusion	1 (0.1%)	21	0.88 (0.87-0.90)	0.72
Hospital stay				
≤ 1 day	1331 (84%)	6 (2.9%)	Ref	
2-3 days	186 (11.7%)	108 (52.4%)	128.8 (55.8-297.2)	<0.001
4-7 days	54 (3.4%)	90 (43.17%)	369 (154.8-882.5)	<0.001
≥7 days	13 (0.8%)	2 (1.0%)	0.08 (0.014-0.44)	0.004

Ref: Reference group.

lower rate of Caesarean section deliveries at Muhima District Hospital, 10.3%, than at CHUK, 15.4 % (OR=0.63; 95% CI 0.46-0.86; p=0.004). Additionally, PPH and third-degree laceration was more common at CHUK hospital (Table 4). After controlling for the site of delivery, IOL was still associated with a higher C/S rate (OR=3.14; 95% CI 2.18-4.51; p<0.001). Women who delivered at CHUK were more likely to be overweight or obese (overweight 48.5%; obese 17.7%) than those who delivered at Muhima District Hospital (overweight 42.1%; obese 6.1%, p<0.001). This may have implications on the baseline Caesarean section at CHUK as obesity has been associated with higher Caesarean section rates.

Prior studies were limited by size or by the use of spontaneous labor as the control, which is not an appropriate comparison group [12–14]. Randomized control trials of well-dated patients do not exist in sub-Saharan Africa. Most studies are a mix of elective and medically indicated inductions, resulting in a bias towards poor outcomes in those who were induced. In sub-Saharan Africa, there is still a significant unmet need for medically indicated induction, compounded with a lack of supplies, training, and monitoring in healthcare settings [7]. In low resource countries, controversy exists over induction risks and whether elective induction is appropriate prior to 41 weeks.

Table 4: Maternal complications stratified by hospital

	CHUK	Muhima	OR (95% CI)	p-value
PPH	18 (4.3%)	7 (0.5%)	8.63 (3.68-20.8)	<0.001
Third-degree perineal tear	11 (2.6%)	10 (0.7%)	3.62 (1.52-8.59)	0.002
Fourth-degree perineal tear	1 (0.2%)	0	4.24 (3.9-4.61)	0.072
Uterine rupture	0	1 (0.1%)	1.31 (1.27-1.34)	0.578
Cesarean section	65 (15.4%)	141 (10.3%)	0.63 (0.46-0.86)	0.004

DISCUSSION

Induction rates vary widely globally, with higher rates documented in developed and affluent countries [10]. A recent trial of 6,106 nulliparous women, with established gestational age and no medical or obstetric indications for delivery,

were randomized at 34 to 38 weeks. This study demonstrated that elective induction at 39 weeks was associated with improved composite perinatal morbidity and lower Cesarean section rates [11].

Important to the current study's relevance, rates of induction of labor are not well documented in Rwanda.

Our observational study attempts to document the rates of induction in a selected group of women. These women lack medical or obstetric indications for delivery, leading to a bias towards poor perinatal outcomes. All the induction group patients were post-term, and the comparison group included women in spontaneous labor. In our study, the rate of labor induction was higher than the WHO Global Survey rates, with an overall rate of 13.8% [7]. The

rate at the University Teaching Hospital of Kigali was 33.8%, compared to 7.6% at Muhima District hospital. The observed difference in induction rates is likely related to the management of pregnancies at the teaching hospital, which includes midwives and obstetricians with protocols for induction. The predominance of the pregnancies at the University Teaching Hospital (96%) had their gestational age identified either by the LMP or first-trimester ultrasound dating. The induction rates reflected by the University Teaching Hospital of Kigali in this study is likely not reflective of hospitals and health centers that do not have obstetricians managing pregnancies. In fact, the overall induction rate in Rwanda is likely different. Our cohort also represents a highly selected group of women without obstetric complications. The goal was to compare outcomes by minimizing comorbidities that might increase the risk of maternal and neonatal complications.

We found that the overall rate of C/S was 11.5%, which is within the WHO recommendations of keeping cesarean section deliveries at only 10 to 15% of total deliveries [15,16] This study cannot be used to conclude on the general rate of C/S because a specific group of women without other comorbidities were observed. Data on all women who delivered during the study period was not included. Logistic regression revealed that IOL was associated with a three-fold higher rate of C/S than spontaneous labor (25.1% versus 9.3%) as well as higher rates of PPH, transfusions, and ICU admissions. The longer hospital stay time is likely a reflection of the time necessary for induction and the time associated with a Cesarean Section delivery. We found that Cesarean Section, PPH, and other complications were higher at the teaching hospital, which is likely a reflection of differences in populations and obstetric practice. However, even after controlling for the site of care, there was still an associated increase of cesarean section following induction. The most common indications for Cesarean Section were non-reassuring fetal heart testing and prolonged labor, and these indications did not differ between the induction (83.9%) and spontaneous labor (88.2 %) groups. The use of spontaneous labor as a control group inherently biases outcomes towards a higher Cesarean section rate in the induction group. There were no differences in neonatal outcomes between the groups.

The study was limited by an unequal distribution of study participants between the two hospital sites and a smaller number of participants in the induction group than the spontaneous group. Although both hospitals are located in Kigali, they differ in patient demographics and management protocols. Further prospective randomized studies with accurately dated pregnancies are necessary to evaluate if labor induction is associated with a higher risk of complications.

CONCLUSION

Health care providers should be prepared for the potential increase of risks associated with induction and be prepared to complete early detection, intervention, and management of complications. The proper selection of candidates for induction of labor is recommended to minimize the risk of poor maternal and neonatal outcomes. Our study did not demonstrate any differences in neonatal outcomes between the two groups.

Due to the potential for an increased risk of Cesarean section or hemorrhage, labor induction requires that the delivery be performed where emergency obstetric care is available. Improvements in antenatal care at the Health Center and District Hospitals, as well as consistent ultrasound dating of pregnancies with unknown LMP, may avoid unnecessary inductions. Prospective trials of induction of labor should be performed in sub-Saharan Africa to demonstrate whether improvements in perinatal morbidity can occur without significant increases in maternal morbidity.

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