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Elucidating Adverse Maternal Outcomes and Their Determinants among Women Undergoing Trial of Labor after Cesarean Section in Uganda: an Institutional Based Prospective Cohort Study

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Abstract: *Background*: Whereas many authorities across the world recommend that trial of labor after cesarean section be offered to all those eligible, it is crucial that women be counseled about the benefits and associated harm so as to help with this decision. However, there is lack of robust comprehensive information on the associated outcomes and their determinants so as to enable the counseling of the eligible women about this choice. *Materials and Methods*: A prospective cohort study was conducted in the months of August 2021 to October 2021. A total of 350 pregnant women above 28 weeks of gestation with previous cesarean section admitted at the maternity ward of HRRH were consecutively enrolled. Interviewer administered questionnaires were used to obtain data. Descriptive statistics followed by binary logistic regression were conducted. All data analyses were conducted using STATA 14.2. *Results*: The incidence of adverse maternal outcomes was 87%. The determinants of adverse maternal outcomes were rural residence (aOR=3.01, CI:0.002-4.059; p<0.001), low family income (aOR=4.8, CI:2.21-10.46; p<0.001) and short interpregnancy interval (aOR=0.2, CI:0.05-0.57; p=0.004). Pregnant women with history of vaginal delivery following previous cesarean section were less likely to experience the adverse outcomes. *Conclusion*: The incidence of adverse maternal outcomes among pregnant women undergoing TOLAC at HRRH is very high. Most women who undergo TOLAC at HRRH do not succeed. Women of rural residence; low family income and short interpregnancy interval have higher odds of adverse maternal outcomes while pregnant those who have had vaginal delivery following previous cesarean section are less likely to experience adverse outcomes.

Key words: Trial of Labor after Cesarean Section, Vaginal Delivery After Cesarean Section, Maternal Outcomes, Cesarean Delivery, TOLAC.

INTRODUCTION

The rates of cesarean sections have been on a steady increase all over the world [1]. Repeat cesarean section is one of the major reasons which have greatly contributed to the high rates of the cesarean delivery. This has been of particular concern to both the mothers and their attending obstetricians world over [2]. Accordingly, TOLAC has been recommended by many authorities as a relatively safe way of decreasing the ever rising rate of cesarean sections globally [3]. In the sub-Saharan African countries, the rates of TOLAC have been noted to range between 37% and 97% [4] and indeed, several studies have been conducted regarding the associated adverse pregnancy outcomes and the factors affecting the success and outcomes of TOLAC. Many of them have raised great concern surrounding complications such as uterine rupture or uterine dehiscence that may occur with vaginal birth after cesarean section and, as such, vaginal birth after cesarean section rates have declined [5].

In Uganda, maternal deaths remain a major point of concern among many communities and is still high [6]. Considerably, morbidity and mortality rates secondary to trial of labor are less than those of repeat cesarean sections and for long, planned trial of labor after previous cesarean section has been noted to be a clinically safe

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choice for the majority of women with a single previous cesarean section [7]. Whereas many authorities recommend that women should be counseled about the benefits and the harm of repeat cesarean section, there is lack of robust comprehensive information on the associated outcomes and their determinants so as to counsel eligible women about this choice particularly in this setting where the study was conducted.

MATERIALS AND METHODS

This was a prospective cohort study thatcovered a period of three months; from August 2021 to October 2021. The study was conducted in both the maternity and postnatal wards of Hoima Regional Referral Hospital located in the centre of Hoima city, Midwestern Uganda, approximately 230 kilometers by road from the capital Kampala. HRRH is a public hospital owned by the government of Uganda but also serves as a satellite tertiary teaching hospital for Kampala International University Western Campus. The hospital is well equipped with an overall bed capacity of 400; 115 beds of which are for the obstetrics and gynecology department where the study was centered. A total of 350 pregnant women both adults and emancipated minors above 28 weeks of gestation with previous cesarean section attending maternity unit for delivery at Hoima Regional Referral Hospital who met the WHO criteria for trial of labor admitted at the maternity ward were consecutively enrolled until the required sample size was achieved. The WHO criteria highlighted by ALARM [5] was considered. This included vertex presentation, documented previous low transverse uterine scar, previous operative report (which included opinion of the previous obstetrician) and no contraindications to vaginal delivery. The contraindications included previous classical cesarean section, inverted T uterine incision, previous uterine rupture and previous major uterine reconstruction, for example; full thickness repair for myomectomy, repair of mullerian anomaly, cornual resection and inability of health care facility to perform emergency cesarean section among others. Voluntary recruitment of all the study participants was done and an informed consent document was signed. Informed consent from the participants was obtained after fully explaining the details of the study to them in English and Runyoro-Rutooro, the dominant local language for those who did not understand English. Emancipated minors required no presence of their guardians to consent. Participants were not forced to enroll for the study if they did not want to. Participants were free to withdraw from the study at any time they wished without coercion or compromise of care they were entitled to. A sample size of 350 was used, estimated using Daniel formula [8] for sample size estimation. Interviewer administered questionnaires were used to obtain all the necessary data. All the collected data were entered into Microsoft excel version 2010 and then imported into STATA version 14.2 for analysis. Both bivariate and multivariate model analyses were carried out to estimate the determinants. The variables in the final multivariate model were significant when $p<0.05$. The measure of association was reported as odds ratios with corresponding 95% confidence interval and p-value.

RESULTS

Of the 350 pregnant women enrolled into the study, the incidence of adverse maternal outcomes was 305(87%). This is shown in Figure 1. Majority, 274 (89.8%) of the 305 pregnant women who experienced adverse outcomes following TOLAC ended up in failure. 13 (4.2%) of the women sustained primary postpartum haemorrhage, while 6 (2%) suffered uterine rupture and intensive care unit admission as well. 4 (1.3%) sustained third and fourth degree perineal tears while 2 (0.7%) were done cesarean hysterectomy.

We run a bivariate analysis model to establish the determinants of the adverse outcomes at this hospital which revealed eight variables statistically significant; that is: residence, occupation, average monthly income in the family, marital status, gravidity, parity, history of vaginal delivery and interpregnancy interval. This is presented in Table 1. All the eight variables were then entered into a multivariable model analysis which revealed four variables; that is: residence, average monthly income in the family, history of vaginal delivery and interpregnancy interval as the independent determining factors for adverse maternal outcomes among women undergoing TOLAC at HRRH ($p<0.05$). Specifically, pregnant women of rural residence with one previous scar were three times more likely to experience adverse maternal outcomes compared to the urban women (aOR=3.01, CI: 0.002-4.059; $p<0.001$). Also, pregnant women of low average monthly income less than 200, 000 Uganda shillings (about 56.20 USD) were more than fourfold likely to experience adverse maternal outcomes compared to those of higher average monthly income (aOR=4.8, CI:2.21-10.46, $p<0.001$). Similarly, women with no history of vaginal delivery were more than twofold the

Table 1: Bivariate analysis of the determinants of adverse maternal outcomes among women undergoing TOLAC at HRRH (N= 350)

		Adverse Maternal Outcome			
		Yes (n=305)	No (n=45)	cOR(95%CI)	*p*
Age	<20	32	0	1.00	0.072
	20-30	233	39	1.6(0.84-3.13)	
	≥30	40	6	0.3(0.05-1.30)	
Level of education	No formal	38	6	1.00	0.584
	Primary	162	27	0.8(0.50-1.32)	
	Secondary+	105	12	0.5(0.33-2.09)	
Residence	Rural	212	13	5.6(2.82-11.18)	<0.001*
	Urban	93	32	1.00	
Occupation	Peasant farmer	170	6	1.5(1.17-1.83)	<0.001*
	Housewife	73	20	0.2(0.11-3.21)	
	Civil servant	0	6	0.8(0.41-5.03)	
	Business	48	13	1.00	
	Others	14	0	1.1(0.3-3.01)	
Av. monthly income in family	<200, 000	185	13	3.2(0.97-4.35)	<0.001*
	>200, 000	120	32	1.00	
Marital status	Single	51	0	1.00	0.003*
	Married	254	45	2.0(0.06-7.45)	
Gravidity	<3	141	13	1.00	0.001*
	3-4	132	19	2.1(1.32-3.23)	
	≥5	32	13	0.9(1-3.15)	
Parity	<2	183	13	1.00	<0.001*
	2-4	102	32	1.2(0.99-1.53)	
	≥5	20	0	1.1(0.33-2.19)	
Gestational age	<36.6	33	7	1.00	0.180
	37-41.6	254	38	0.5(0.25-1.12)	
	≥ 42	18	0	0.1(0.51-3.18)	
PNC attendance	Yes	285	44	1.00	0.277
	No	20	1	0.3(0.04-2.47)	
Number of PNC attendance	<4	160	19	1.00	0.200
	≥4	145	26	1.5 (0.80-2.84)	
First trimester PNC attendance	Yes	92	18	1.00	0.185
	No	213	27	0.6 (0.34-1.23)	
H/o vaginal delivery	Yes	115	32	1.00	<0.001*
	No	190	13	0.2(0.12-0.49)	
Interpregnancy interval	>18 months but <3 years	156	6	6.8(2.799-16.544)	<0.001*
	≥3 years	149	39	1.00	
Pre-pregn. BMI	>30	39	6	1.00	0.919
	<30	266	39	1.6(.379-2.398)	

*p<0.05.cOR = crude odds ratio, CI = confidence interval, p = significance level

Incidence of Adverse Maternal Outcomes among Women Undergoing TOLAC at HRRH

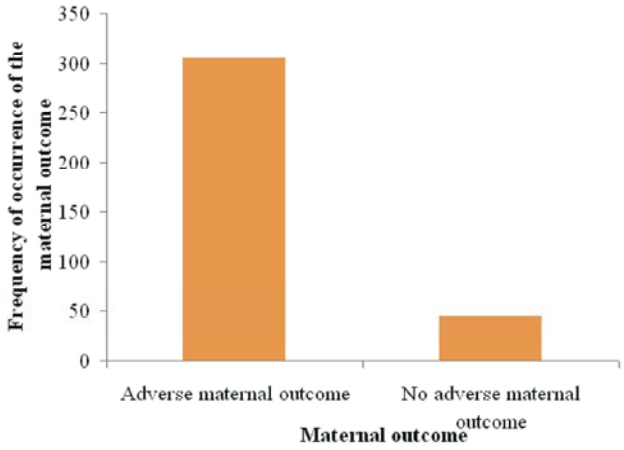

Fig. 1: Incidence of adverse maternal outcomes among women undergoing TOLAC at HRRH.

Immediate Adverse Maternal Outcomes among Women Undergoing TOLAC at HRRH

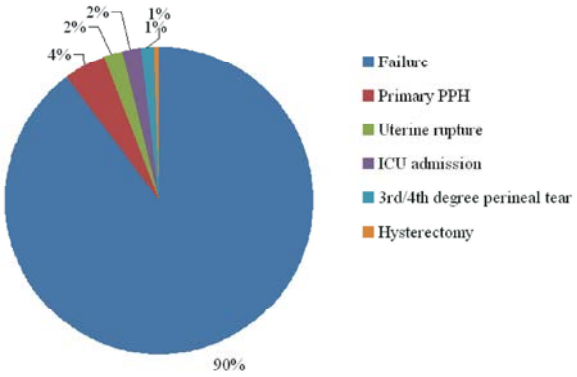

Fig. 2: Immediate adverse maternal outcomes among women undergoing TOLAC at HRRH

Table 2: Multivariate analysis of factors associated with adverse maternal outcomes among women undergoing TOLAC at HRRH (N = 350)

		Adverse Maternal Outcome				
		Yes (n=305)	No (n=45)	cOR(95%CI)	aOR(95%CI)	*p*
Residence	Rural	212	13	5.6(2.82-11.18)	3.01(0.002-4.059)	<0.001*
	Urban	93	32	1.00		
Occupation	Peasant farmer	170	6	1.5(1.17-1.83)	1.01(0.63-1.6)	0.971
	Housewife	73	20	0.2(0.11-3.21)	0.9(0.001-0.27)	0.057
	Civil servant	0	6	0.8(0.41-5.03)	1.1(0.81-1.94)	0.93
	Business	48	13	1.00		
	Others	14	0	1.1(0.3-3.01)	2.4(1.17-13.21)	0.71
Av. monthly income in family	<200, 000	185	13	3.2(0.97-4.35)	4.8(2.21-10.46)	<0.001*
	>200, 000	120	32	1.00		
Marital status	Single	51	0	1.00		
	Married	254	45	2.0(0.06-7.45)	1.3(0.05-0.24)	0.102
Gravidity	<3	141	13	1.00		
	3-4	132	19	2.1(1.32-3.23)	0.7(0.24-2.31)	0.61
	≥5	32	13	0.9(1-3.15)	0.4(0.10-1.95)	0.46
Parity	<2	183	13	1.00		
	2-4	102	32	1.2(0.99-1.53)	1.2(0.06-5.17)	0.55
	≥5	20	0	1.1(0.33-2.19)	0.3(0.27-4.31)	0.91
H/o vaginal delivery	Yes	115	32	1.00		
	No	190	13	0.2(0.12-0.49)	2.1(0.43-3.19)	<0.001*
Interpregnancy interval	>18 months but <3 years	156	6	1.00		
	≥3 years	149	39	6.8(2.799-16.544)	0.2(0.05-0.57)	0.004*

*p<0.05, cOR= crude odds ratio, aOR = adjusted odds ratio, CI= confidence interval, p = significance level, Av.=average

risk of adverse maternal outcomes compared to the ones who had vaginal delivery before (aOR=2.1, CI: 0.43-3.19, p<0.001). Women with interpregnancy interval of three years or more showed lower odds of experiencing adverse maternal outcomes compared to those below three years (aOR=0.2, CI:0.05-0.57; p=0.004). This is illustrated in Table 2.

DISCUSSION

The overall incidence of adverse maternal outcomes among women undergoing TOLAC at Hoima Regional Referral Hospital was 87%. This finding was much higher than findings of previous scholars such as the one of Kalisa, Rulisa, Roosmalen and Akker [4] in Rwanda where the incidence was 7.7% and that of Ghazi [1] in Iraq which was reported to be 12.6%.This discrepancy is probably due to the differences in the methodologies used for the different studies. For instance, the fact that their study recruited only women above 36 weeks, while the current study, in addition to those bove 36 weeks, recruited those below 36 weeks could explain this discrepancy.

According to our study, the most outstanding adverse outcome was failure. Majority (89.8%) of the women who underwent TOLAC ended up in failure and therefore subsequently delivered by emergency cesarean

section. Consistent observation has been documented by Onah *et al*. [9] in Nigeria, Elnahas & Ahmed [10] in Sudan, Nair *et al*. [11] in the UK and Thapsamuthdechakorn, Sekararithi and Tongsong [12] in Thailand. Frass and Harazi [13] in Yemen however noted a different observation. Their study registered a low failure rate of only 15% with no increased risk of maternal morbidity or mortality. This discrepancy is probably attributed to the differences in the methods used. Unlike the current study, their study did not include women who did not have spontaneous onset of labor, those that had not reached term and the post-date pregnancies. These are generally known obstetric risks that could probably exacerbate the possibility of failure in any pregnant woman with one previous scar undergoing trial of labor. This probably contributed to our high incidence.

We noted that 4.2% of the women sustained primary postpartum haemorrhage, 1.3% sustained third and fourth degree perineal tears while 0.7% underwent cesarean hysterectomy. We however registered no any maternal death following the trial of labor. This is consistent with the results of Siraneh, Assefa, & Tesfaye (14) at Attat Catholic Primary Hospital in South Ethiopia and Komakech (15) in Mulago hospital in Uganda. Our study noted 2% cases of uterine rupture following the trial of labor. This was comparable to the results of Kathryn, Jennifer, Sohinee & Maria (16), Pembe and Othman (17) in Tanzania and Komakech (15) in Uganda. However, this was different from findings of Charitou, Charos, Vamenou and Vivilaki (18) in Greece where no perinatal death incident was observed and the risk of uterine rupture was zero.

The current study established that pregnant women of rural residence with one previous scar were more likely to experience adverse maternal outcomes compared to the urban women. The odds of adverse maternal outcomes among rural residents was more than three time as those residing in urban areas (aOR=3.01, CI: 0.002-4.059; p<0.001). As suggested by Mosiur, Syed and Sarwar (19), pregnant women who reside in rural areas with limited access to health care services are likely to have poor health care seeking behaviors particularly regarding seeking antenatal care which may contribute to such adverse obstetric outcomes. For example, analysis by Harrison *et al*. (20) suggested that four or more antenatal care visits during pregnancy was associated with 40% fewer adverse outcomes in women who experienced an intrapartum cesarean birth.

Also, pregnant women of low average monthly income less than 200, 000 Uganda shillings (about 56.20 USD) were more than fourfold likely to experience adverse maternal outcomes compared to those of higher average monthly income (aOR=4.8, CI: 2.21-10.46;p<0.001). It is likely that these women, because of their low socioeconomic status are likely to report to hospital late, have low healthcare seeking behavior including for antenatal care. These are prone to obstetric complications, not only during labor but also after delivery. Similarly, women with no history of vaginal delivery were more than twofold the risk of adverse maternal outcomes compared to the ones who have had a vaginal delivery before (aOR=2.1, CI: 0.43-3.19;p<0.001). Previous vaginal delivery after a previous cesarean section has been noted to be a significant predictor of successful vaginal delivery. Women with interpregnancy interval of three years and more showed lower odds of experiencing adverse maternal outcomes compared to those below three years (aOR=0.2, CI:0.05-0.57;p=0.004). Prior researchers such as Ghazi (1) in Iraq have shown significant association between interpregnancy interval and mode of delivery. Recently, the spacing between pregnancies has become a crucial factor in quite a number of obstetric outcomes, including but not limited to the success of trial of labor after cesarean delivery, puerperal infections, birth weight and so forth. A long interpregnancy interval allows sufficient time for adequate healing of the previous cesarean scar, hence giving an opportunity for the higher success of trial of labor with minimal maternal complications.

Study Strengths: This is the first documented study conducted at Hoima Regional Referral Hospital and the entire western Uganda. Also, a comparatively higher sample size than most other related studies was used and therefore more precision.

Study Limitations: The design of this study could not permit better comparison since we did not have a control group. A future case control study conducted in this particular area so as to strengthen these findings is highly desired.

CONCLUSION

Most women who undergo TOLAC at Hoima Regional Referral Hospital do not succeed. Women of rural residence, low family income and short interpregnancy interval have higher chances of sustaining adverse maternal outcomes. Pregnant women who have had vaginal delivery following previous caesarean section are less likely to experience adverse maternal outcomes.

Abbreviations

ALARM: Advances in Labor and Risk Management, **PNC:** Prenatal care, **TOLAC:** Trial of Labor after Cesarean Section, **HRRH:** Hoima Regional Referral Hospital, **WHO:** World Health Organization.

Ethics Approval and Consent to Participate in the Study: Voluntary enrollment of all the study participants both adults and emancipated minors was done. Informed written consent from participants was obtained after fully explaining the details of the study in English and Runyoro-Rutooro, the dominant local language for those who did not understand English. Emancipated minors required no presence of their guardians to consent. A participant was free to withdraw from the study at any time she wished, without coercion or compromise of care that she was entitled to. The study was approved by the Research Ethics Committee of Kampala International University, approval number; KIU-2021-33.

Availability of Data and Materials: The datasets used and/or analyzed during the current study are available from the corresponding authors on reasonable request.

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