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Is Prolonged Labor Managed Adequately in Rural Rwandan Hospitals?

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Abstract

Unnecessary interventions to manage prolonged labor may cause considerable maternal and perinatal ill-health. We explored how prolonged labor was managed in three rural Rwandan hospitals using a partograph. A retrospective chart review was done to assess whether (A) the action line on the partograph was reached or crossed, (B) artificial rupture of membranes (ARM) performed, (C) oxytocin augmentation instituted, and (D) vacuum extraction (VE) considered when in second stage of labor. Adequate management of prolonged labor was considered if three clinical criteria were fulfilled in the first and four in the second stage. Out of 7605 partographs, 299/7605 women (3.9%) were managed adequately and 1252/7605 women (16.5%) inadequately for prolonged labor. While 6054 women (79.6%) remained at the left of the alert line, still 1651/6054 (27.3%) received oxytocin augmentation unjustifiably. Amongst women whom were managed adequately for prolonged labor until their cervical dilatation plot reached or crossed the action line. In 115/299 women (38.5%), however, second stage of labor was reached but CS performed without a trial of VE. In 1252/7605 women (16.5%) management was inadequate, when their cervical dilatation plot reached between the alert and action lines, 495/1252 women (39.5%) did not reach the second stage of labor and remained left of the action line had their membranes ruptured and labor augmented, and gave birth by CS. CS was, however, also performed in 151/1252 women (12.1%) whose membranes were still intact. We recommend training for more appropriate decision-making during labor to prevent unnecessary CS and proper use of ARM, oxytocin augmentation and VE can be provided safely. *(Afr J Reprod Health 2019; 23[2]: 27-34).*

Keywords: Cesarean section, oxytocin, partograph, prolonged labor, vacuum extraction

Résumé

Des interventions inutiles pour gérer le travail prolongé peuvent entraîner de graves problèmes de santé maternelle et périnatale. Nous avons exploré la gestion du travail prolongé dans trois hôpitaux ruraux rwandais à l'aide d'un partogramme. Une analyse rétrospective des diagrammes a été réalisée pour déterminer si (A) la ligne d'action sur le partogramme était atteinte ou croisée, (B) une rupture artificielle des membranes (RAM) a eu lieu, (C) une augmentation de l'ocytocine était instituée et (D) une extraction sous vide (VE) a été prise en compte lors du deuxième stade du travail. Une gestion adéquate du travail prolongé était envisagée si trois critères cliniques étaient remplis au premier et quatre au deuxième stade. Sur 7605 partogrammes, 299/7605 femmes (3,9%) étaient gérées de manière adéquate et 1252/7605 femmes (16,5%) de manière insuffisante pour un travail prolongé. Alors que 6054 femmes (79,6%) sont restées à la gauche de la ligne d'alerte, 1651/6054 (27,3%) ont quand même bénéficié d'une augmentation d'ocytocine de manière non justifiable. Parmi les femmes qui ont été bien traitées pour un travail prolongé jusqu'à ce que leur dilatation cervicale atteigne ou croise la ligne d'action. En 115/299 femmes (38,5%), cependant, le deuxième stade du travail a été atteint mais l'OC a été effectué sans essai de VV. Chez 1252/7605 femmes (16,5%), la prise en charge était inadéquate, 495/1252 femmes (39,5%) n'atteignaient pas le second stade du travail et restaient à gauche de la ligne d'action. Leurs membranes se sont rompues et le travail a augmenté et a donné naissance à l'OC. L'OC était cependant également pratiquée chez 151/1252 femmes (12,1%) dont les membranes étaient encore intactes. Nous recommandons une formation pour une prise de décision plus appropriée pendant le travail afin de prévenir les OC inutiles et l'utilisation appropriée de la RAM, l'augmentation d'oxytocine et de VV peut être adoptée en toute sécurité. *(Afr J Reprod Health 2019; 23[2]: 27-34).*

Mots-clés: Opération césarienne, ocytocine, partogramme, travail prolongé, extraction sous vide

Introduction

According to the World Health Organization, prolonged labor is defined as active labor lasting more than 12 hours[1]. It may precede the development of cephalopelvic disproportion, which is a syndrome characterized by signs of failure of descent of the presenting part of the fetus for mechanical reasons in spite of good uterine contractions[1-3]. Prolonged labor has been inherently difficult to diagnose and subjected to controversy ever since Friedman's graphic analysis of labor in 1954 expecting that the cervix dilates by at least 1 cm/hour in all women[4]. From the beginning of this century labor curves emerged among white and Asian women[5,6] which suggested that labor progresses more slowly than previously thought. In sub-Saharan Africa it took more than one hour for one cm of cervical dilatation until it was at least 5 cm in both nulliparous and multiparous women[3,7]. This lead to potential misclassification as 'abnormal' labor progress subjecting women to unnecessary labor interventions like oxytocin augmentation and emergency cesarean section (CS)[8].

Causes of prolonged labor include inefficient uterine contractions, malpresentation, malposition and cephalo-pelvic disproportion, especially in primiparous. In case of disproportion between the maternal pelvis and fetal head in the presence of good contractions, prolonged labor may become obstructed if neglected[9,10]. Low socioeconomic status, illiteracy, and inadequate antenatal care are associated with prolonged/obstructed labor[11,12], which may lead to ruptured uterus, puerperal sepsis, postpartum hemorrhage, secondary infertility, vaginal scarring and stenosis, musculoskeletal injury, urinary incontinence, obstetric fistula and post-traumatic stress disorder[13,14]. In the new-born, prolonged labor may lead to birth asphyxia, resulting in stillbirth, neonatal death, cerebral palsy or developmental disabilities[10,13,14].

Assessment of labor progress should identify women with prolonged labor and prevent them from developing obstructed labor. Early diagnosis of prolonged labor, combined with appropriate interventions like amniotomy and oxytocin augmentation to speed up slow progress and encourage dilatation[15] with continued monitoring, is necessary to exclude inefficient uterine action as cause of prolonged labor before reaching to a diagnosis of cephalopelvic disproportion. Accurate diagnosis, treatment and follow-up of prolonged labor will prevent unnecessary CS (which may harm the woman, her baby and future offspring). In such cases, access to skilled birth attendants and use of partograph would engender gross reduction in the number of these deaths since markers of abnormal progress of labor would be identified earlier[1,15,16].

In Rwanda, obstructed labor was found to be the leading cause of maternal deaths[17]. At the same time, prior studies[18-20] have revealed an increased number of CS with doubtful indications, associated with few instrumental vaginal deliveries, and poor labor monitoring and management. We sought to explore how often prolonged labor was adequately managed and compared labor progress and fetal outcomes of prolonged and uncomplicated labor using the partograph in rural Rwandan hospitals.

Methods

A retrospective chart review of obstetric records between January 2011 and December 2011 was conducted to evaluate the completion of partographs used to monitor women who were managed for uncomplicated and prolonged labor in three public hospitals in rural Rwanda: Ruhengeri, Gisenyi and Shyira. The annual number of births in these hospitals was approximately 3500, 3200 and 2600, respectively. Ruhengeri hospital acts as a provincial referral hospital for women with high-risk pregnancies and complications. The other two are district hospitals. During the study period there was one obstetrician at Ruhengeri hospital, while other hospitals had only medical officers and nurse-midwives.

Every partograph was assessed according to the following criteria: A) whether the action line was reached or crossed, and subsequently B) whether membranes were artificially ruptured, C) whether oxytocin augmentation was performed, D) whether assisted vaginal delivery was considered in case the woman reached the second stage of labor. A woman was 'adequately managed for

Table 1: Socio-demographic characteristics of pregnant women in Rural Rwanda

Variables	**Prolonged labor**[a, b] (N=1551) n /N (%)	**Uncomplicated labor** (N=6054) n /N (%)	**OR** (95% CI)
Maternal Age (years)			
15-19	164 (10.6)	476 (7.9)	1.4 (1.1-1.7)
20-29	1006 (64.9)	3999 (66.0)	1
≥ 30	381 (24.5)	1579 (26.1)	0.9 (0.8-1.1)
Number of deliveries			
1	538 (34.7)	1440 (23.8)	1.7 (1.5-1.9)
2-4	713 (46.0)	2734 (45.1)	1
≥ 5	300 (19.3)	1880 (31.1)	0.5 (0.4-0.6)
Maternal Education			
None or Primary	1187 (76.5)	3893 (64.3)	1.8 (1.6-2.1)
Secondary and above	364 (23.5)	2161 (35.7)	1
Antenatal care visits			
< 4	1139 (73.4)	3393 (56.0)	2.2 (1.9-2.5)
≥ 4	412 (26.6)	2661 (44.0)	1
District of Residence			
Musanze	402 (25.9)	2258 (37.3)	1
Rubavu	451 (29.1)	1943 (32.1)	0.8 (0.7-1.0)
Nyabihu	539 (34.8)	1307 (21.6)	1.9 (1.7-2.2)
Others*	159 (10.2)	546 (9.0)	1.2 (0.9-1.4)

Prolonged labor [a, b] included all those who were managed adequately or inadequately for prolonged labor, respectively.
Other* districts included; Prolonged labor [a, b] was Burera (79), Gakeke (51), Rulindo (24), Gicumbi (5) while uncomplicated labor was Burera (357), Gakeke (116), Rulindo (41), Gicumbi (32)

Table 2: Labor progress, mode of delivery and fetal outcomes in pregnant women managed for prolonged and uncomplicated labor

Variable	**Cervical dilatation plot**			**p-value**
	Left of alert line (*n*=6054)	Between alert and action line [a] (*n*=1252)	Reached or crossed the action line [b] (*n*=299)	
Mode of delivery				
Spontaneous vaginal	5720 (94.5)	165 (13.2)	9 (3.0)	0.000
Vacuum extraction	278 (4.6)	56 (4.5)	12 (4.0)	0.73
Caesarean section	56 (0.9)	1031 (82.3)	278 (93.0)	0.000
Membranes ruptured	1799 (29.7)	1048 (83.7)	299 (100)	0.000
Oxytocin augmentation	1651 (27.3)	754 (60.2)	291 (97.3)	0.000
Fetal outcomes				
Low (Apgar 1–6)	691 (11.4)	63 (5.0)	48 (16.1)	0.000
Stillbirth	84 (1.4)	53 (4.2)	32 (10.7)	0.000

[a]Inadequate management of prolonged labor was defined as documentation of the partograph with less than 3 clinical criteria in the first or four in the second stage and these were; i) action line on partograph not crossed ii) membranes ruptured, iii) oxytocin augmentation done, iv) assisted vaginal delivery performed (when patient reached second stage).
[b]Adequate management of prolonged labor was defined as documentation of the partograph with 3 clinical criteria in the first or four in the second stage and these were; i) action line on partograph crossed, ii) membranes ruptured, iii) oxytocin augmentation done iv) assisted vaginal delivery performed (when patient reached second stage).

prolonged labor' if three clinical criteria were fulfilled in the first or four in the second stage. All women admitted in spontaneous labor with a cervical dilatation of four or more centimeters[2] at the end of an uncomplicated pregnancy with a gestational age of at least 37 weeks were included. All other women, including those with, for instance, preterm labor, eclampsia, antepartum hemorrhage, multiple pregnancies or intrauterine fetal death were excluded.

Data were extracted from obstetric case files and pretested on 150 files for the year 2010.

Data collected were maternal age, parity, educational level, antenatal care, residence, completion of partographs; rates of plots of cervical dilatation not crossing the alert line (therefore indicating uncomplicated labor), crossing the alert line but not reaching the action line, or reaching or crossing the action line; mode of delivery rates for women within each of these three categories of labor progress and for those who underwent rupture of membranes; augmentation of labor with oxytocin and fetal outcomes. The baby's condition after birth was assessed using Apgar scores 5 minutes after birth since no facilities for cord blood sampling were available. Data were collected in three hospital archives by two trained visiting last year medical students from the Netherlands and the principle investigator.

Data were entered in Epidata and analyzed using SPSS statistical software, version 20. Descriptive statistics were obtained through frequencies and cross tabulations. A one-way ANOVA was used to compare means and standard deviations of characteristics between women who had prolonged and uncomplicated labor. Different outcomes measured were: rates of cervical dilatation not crossing the alert line; between alert and action line; reaching or crossing the action line; mode of delivery; ruptured membranes; labor augmentation; and fetal outcomes. Outcomes were then compared between prolonged labor and uncomplicated labor. Chi square $\chi 2$ test and t test were used, with statistical significance set at an α level of 0.05.

Ethical permission to undertake this study was granted by the National Ethical Committee (reference identification: N°582/RNEC/2013). Permission to access obstetric records was obtained from the medical directors of the respective hospitals.

Results

Table 1 shows socio-demographic characteristics of women managed as prolonged labor compared to uncomplicated labor. Women managed for prolonged labor were more often younger than 19 years of age and primiparous. They more frequently had no formal education, or primary education only, more often did not attend the recommended number of four antenatal visits, and more often resided in Nyabihu district.

Labor progress is shown in Table 2. Of all 7605 women, 6054 women (79.6%) remained at the left of the alert line amongst whom 1651/6054 (27.3%) received oxytocin augmentation unjustifiably. Of the remaining women, 299/7605 (3.9%) were managed adequately and 1252/7605 (16.5%) inadequately for prolonged labor and also had more frequent adverse fetal outcomes.

Table 3 shows clinical decisions made among women managed as prolonged labor. Two hundred ninety nine out of 7605 women (3.9%) were managed adequately for prolonged labor until their cervical dilatation plot reached or crossed the action line. In 115/299 women (38.5%), however, second stage of labor was reached but CS was performed without a trial of vacuum extraction. In 1252/7605 women (16.5%) management was inadequate, when their cervical dilatation plot reached between the alert and action lines. Only two out of five women who did not reach the second stage of labor and remained left of the action line had their membranes ruptured and labor augmented, and gave birth by CS. CS was, however, also performed in 151/1252 women (12.1%) whose membranes were still intact.

Discussion

The major findings of this study were that one in three women received oxytocin augmentation despite having no evidence of prolonged labor on the partograph left of the alert line. At the left of the alert line there is generally no reason to speed up the rate of dilation by augmentation and augmentation is potentially dangerous to the fetus due to the possibility of hyperstimulation in absence of adequate fetal monitoring. When women had a tracing between the alert and action lines, one in six women did not have their membranes ruptured of whom three-quarters went on to have cesarean section (CS). One-third of the women reaching the second stage of labor did not have an attempted instrumental vaginal delivery. These omissions in care are likely to cause a considerable number of unnecessary CS.

Table 3: Clinical decisions made among women managed for prolonged labor in Rural Rwanda

† **Clinical decisions made**	**Cervical dilatation plot**	
	Between alert and action line (N=1252) [a]	Reached or crossed the action line (N=299) [b]
Crossed alert or action line	1252 (100)	299 (100)
Membranes intact, but ARM not performed after crossed alert or action line	204 (16.3)	-
Membranes ruptured after crossed alert or action line	1048 (83.7)	299 (100)
Membranes ruptured, oxytocin augmented	754 (60.2)	291 (97.3)
CS done; when membranes still intact	151 (12.1)	-
CS done; after ARM but no oxytocin augmentation	196 (15.7)	8 (2.7)
CS done; after both ARM and oxytocin augmentation, but not in second stage	495 (39.5)	155 (51.8)
Emergency CS performed when cervix fully dilated, no trial of vacuum extraction performed	189 (15.1)	115 (38.5)
Vacuum extraction performed when cervix fully dilated	56 (4.5)	12 (4.0)

Abbreviations: ARM, artificial rupture of membranes; CS, cesarean section
† Multiple clinical criteria

As documented by others[7,11,20], prolonged labor was more prevalent among primiparous women, poorly educated and those who had attended less than four WHO recommended antenatal visits. The finding that women from one specific district (Nyabihu) had the highest risk of crossing the alert line may be attributed to long travel distances to Ruhengeri hospital which provided comprehensive emergency obstetric care at the time. Therefore, attention to women's individual, cultural, personal, and medical needs is essential for universal access to quality care during labor and childbirth[12,21].

The overall incidence of prolonged labor was lower than the national incidence of 12.3%[17] but similar to other African studies (incidence rates between 0.9% - 11%)[14,21]. The over- or underestimation of prolonged labor may have been due to injudicious use of oxytocin drugs without prior assessment of risk factors like fetal size, presentation, stage of labor, position and pelvic adequacy or in those where vacuum extraction was not tried or missing information in the obstetric charts/partographs. This highlights that most women with so called prolonged labor could be managed by appropriate anticipation[2,3,7] and early reporting of pregnant women to peripheral health facilities. Reassessment of labor after the action line is crossed could be appropriately managed by either artificial rupture of membranes in women with still intact membranes, by oxytocin augmentation in case of inadequate uterine contractions when membranes are already ruptured or by considering vacuum extraction in the second stage of labor before CS is performed as the last resort[16,21,22].

Our findings show that one-third of women with uncomplicated active labor at the left of the alert line received unnecessary oxytocin augmentation, while women who passed the alert line and action line had missed opportunities (affecting up to 40%) for labor augmentation. Unfortunately, these women underwent unnecessary emergency CS exposing them and their (future) children to risks of morbidity and mortality and unnecessary costs to their families and health systems[21]. Others have tried to explain it by the notion that has been carried on for generations by health care workers that uncomplicated labor abides by the 'one-centimeter per hour' rule. The rule has recently been found to be less than one cm per hour rate of cervical dilation until it is at least 5 cm among sub-Saharan African women[2,3,7]. This mis-match between unrealistic expectations of health care workers and the physiology of labor may give rise to the constructed 'need' for an intervention in a natural process that could otherwise be slower than currently expected but end well and naturally[2,3,7]. We therefore, re-encourage partograph use - not using unnecessary actions at the left of the alert line as intervention starting point, but with associated unambiguous and achievable guidelines, including a restricted action-line-based augmentation regimen[23]. Other options such as use

of PartoMa guidelines are relevant, which have been found to be simple, relevant and effective in the treatment, triage and prevention of prolonged labor thus reducing CS rates and improved neonatal outcomes[11,22,24]. Also, multifaceted approaches—including targeting of providers—such as dissemination of educational materials, audit and feedback, and targeted educational interventions (i.e. simulations, continuing professional development, drills, and financial incentives) could be instrumental to prevent unnecessary interventions during labor.

Underuse of instrumental vaginal delivery when women reached second stage opting for emergency CS is similar to what others reported in low resource settings[25-27].This highlights several potential interventions; intrapartum HIV testing, labor augmentation with oxytocin, and implementing appropriate training in assisted vaginal deliveries in order to promote the use of vacuum extractor as a safe alternative to CS in certain cases of prolonged second stage of labor[26,27].

Labor outcomes were similar to other studies, where delay in labor progress increased the need for more emergency CS and adversely affected fetal outcomes[11,14,19]. However, other authors have related these adverse fetal outcomes to excessive use of unnecessary labor inventions like oxytocin augmentation particularly in settings where there is limited capacity to provide appropriate, intermittent fetal monitoring[3,7]. There is still ample room for improving partograph use in low-resource settings especially if coupled with such guidelines[2].

The strength of this study was that women sought obstetric care across the border of their district of residence where it was most accessible. Therefore, we believe these results should be considered representative since the socio-demographic factors and pathways to prolonged labor are similar to other district hospitals in Rwanda and sub-Saharan African settings[21]. In terms of limitations, the retrospective nature of this study relied on routinely collected obstetric data, bias may have occurred because of missing information in the obstetric charts or partographs. This may have led to over- or underestimation of prolonged labor. At the time we analyzed data, there was no a global standardized system to routinely audit induction of labor and cesarean deliveries rates within and between healthcare facilities[28,29]. Nonetheless, we accounted for epidemiological variables and analyzed labor events and outcomes. Unfortunately, inadequate documentation is often seen in these settings, and proper documentation should be encouraged for better clinical care in future. While data extracted from partographs was beyond our control, the criteria for partograph adequacy was established a priori and the fulfillment of three clinical criteria in the first or four in the second stage could be applied to each partograph, thus reducing the probability of random error. Future studies should be conducted using the Robson Classification system to allow clinicians to learn from each other and on the basis of their results examine their practice as means to improve the quality of perinatal care[28,29].

Conclusion

There was poor implementation of existing guidelines on how to use the partograph for recording and management of prolonged labor, leading to suboptimal use of artificial rupture of membranes, oxytocin augmentation, vacuum extraction and excessive rate of unnecessary CS. Careful management of interventions is crucial to keep uncomplicated births uncomplicated and avoid mistreatment. Good documentation of progress of labor in birth records is paramount for early identification and prevention of prolonged labor and improves care for women and infants. We recommend training for appropriate decision making in emergency CS, so that vacuum extraction, artificial rupture of membranes, and oxytocin augmentation can be provided safely.

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Author's Contribution

RK and JvR conceived this study. RK designed the study protocol, supervised data collection,

analyzed and interpreted data, and drafted a first manuscript. SR, TvdA, JvR contributed significantly to study design, data analysis, interpretation and manuscript writing. All authors read and approved the final manuscript.

Conflicts of Interest

The authors have declared that no competing interests exit.

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