

OBSTETRIC OUTCOMES AMONG LOW RISK PARTURIENTS WHEN ACTIVE PHASE OF LABOR IS DEFINED AT A CERVICAL DILATATION OF 6 VERSUS 4 CENTIMETRES AT KENYATTA NATIONAL HOSPITAL, KENYA

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Abstract

Background: Neal et al. suggested that active labor started at 6 centimeters (cm) cervical dilatation which differs from Friedman's labor curve of 4cm. The feasibility and risk of adverse obstetric outcomes when active labor starts at 4cm compared to 6cm dilatation has not been studied amongst African women. Objective: Compare incidences of adverse obstetric outcomes among low-risk parturients when active labor starts at 6cm versus 4cm dilatation. Methodology: 180 low-risk parturients in spontaneous labor between 37-42 weeks gestation with a singleton fetus in cephalic presentation and reassuring fetal status were recruited, allotted to 4 cm or 6 cm arms and intrapartum and immediate postpartum outcomes recorded. Demographic characteristics were summarized and Chi-square tests used to evaluate relationships between study arms. P-value was considered significant at <0.05 at the 95% level of confidence. Results: Between January and April 2019, 90 parturients each were recruited to the 4cm and 6cm arms. Demographic and reproductive characteristics were comparable on admission. Defining active labor at cervical dilatation of 4 cm versus 6 cm was not associated with adverse maternal and neonatal outcomes. However, the need for amniotomy and oxytocin was 1.44 (1.09-1.96) and 1.42 (1.07-1.88) times higher when active labor was defined as cervical dilation of 4 cm than 6 cm ($P < 0.05$). Conclusion: Defining active labor at cervical dilatation of 4 cm versus 6 cm was not linked with adverse obstetric outcomes. However, defining active labor at 4 cm than 6 cm increased the risk of amniotomy and oxytocin administration 1.44 and 1.42-fold.

Introduction

Labor onset can be spontaneous or induced with regular or rhythmic uterine contractions. Prolonged labor, especially latent phase, has been associated with increased risk of caesarian deliveries, need for intrapartum interventions, adverse fetal outcomes such as poor APGAR scores at 5 minutes, and admission to newborn intensive care units (NICU) [2,3]. There are some inconsistencies in defining the active phase of labor. In 1978, Friedman observed that active labor started when there is a significantly increased rate of change in cervical dilation [4]. In the 2003 American College of Obstetrics and Gynecologists (ACOG) practice bulletin on approaches to limit intervention during labor and birth, it has been noted that most clinicians defined the active phase of labor at 3 or 4 cm cervical dilation [5]. Also, the 1998 World Health Organization partograph defined the beginning of an active phase of labor at 3 cm with a cervical dilation rate of at least 1 cm per hour [6]. However, recent evidence suggests that defining active labor at cervical dilatation of 5 or 6 centimeters may have similar obstetric outcomes as cervical dilatation happens substantially slower than

originally reported by Friedman in his 1978 published book [7]. Zhang et al. in 2002 reported a substantially slower rate of dilation from 4-10 cm (5.5 hours) compared to what was reported by Friedman (2.5 hours) in 1978, with the 3-4 cm diagnostic criteria for active labor found to be too stringent for nulliparous parturients [8]. A follow-up study by Zhang et al. (2010) and Laughon et al. (2014) also reported substantially lower rates of dilation (0.5-0.7 cm per hour) compared to Friedman's (1 cm per hour) [8,9], supporting earlier findings that the 3-4 cm diagnostic criteria for active labor might be too stringent. Guided by this new evidence, ACOG released a new diagnostic criterion for the active phase of labor in an obstetric care consensus statement in 2014, which advocated for adopting 6 cm cervical dilation as the threshold for the onset of the active phase of labor for most women [10] and later on supported by the World Health Organization (WHO) in 2018 [11]. However, the feasibility and obstetric outcomes of defining the active phase of labor at cervical dilation of 6 compared to 4 centimeters in low-resource settings have not been evaluated. This study sought to compare the obstetrics outcomes of parturients whose active stage of labor was defined at a cervical dilation of 4 cm compared to 6 cm in Kenya.

Methodology

Study design

This was a prospective cohort study that compared obstetrics outcomes of term parturients among whom active stage of labor was defined at a cervical dilation of 4 cm versus 6 cm at Kenyatta National Hospital, the largest teaching, and referral hospital in Kenya.

Power and sample size calculation

Power and sample size calculation was estimated according to Charan and Biswas (27) at an α of 1.96 at 95% confidence interval, statistical power of 80%, and an anticipated incidence of oxytocin administration of 36.6% at 6 cm and 58.5% at 4 cm. The incidence data were obtained from Kauffman et al., 2002 [12]. Assuming a recruitment ratio of 1:1, 162 participants (81 at 4 cm and 81 at 6 cm) were required. After adjustment by a factor of 10% to cover loss to follow up, 180 participants, 50% at 4 cm cervical dilation and 50% at 6 cm cervical dilation were required.

Study procedures

Eligible parturients were those in spontaneous labor at term (37-42 weeks) gestation and having a cervical dilation of either 4 or 6 cm, cephalic presentation, reassuring fetal heart rate. Parturients with a previous uterine scar, multiple gestations, and medical comorbidities such as cardiac disease in pregnancy, diabetes mellitus, chronic hypertension, and HIV/AIDS with unknown viral loads were excluded. On admission, the cervical dilatation was assessed by a skilled trained midwife by performing a sterile vaginal examination which was confirmed using the cervical dilation and effacement chart. Informed consent was obtained from those at 4 cm and 6 cm cervical dilatation respectively until the required sample size (180) was reached. Enrolled participants were then monitored up to 24 hours postpartum and outcome data obtained.

Data collection

Interviewer administered questionnaires were used to collect data on sociodemographic and reproductive characteristics. Additional data was obtained from parturient's medical records. Outcome data such as number of vaginal examinations and intrapartum interventions including amniotomy and oxytocin administration, and mode of delivery were obtained from medical records. Records of adverse maternal outcomes including cervical tears, primary PPH, early onset of sepsis, and adverse neonatal outcomes such as low

5-minute APGAR scores, need for resuscitation and oxygen administration, neonatal sepsis, and NBU admissions were also obtained from maternal and newborn medical records.

Statistical analysis

Categorical data were summarized as proportions and compared using the Chi-square or Fisher's exact test. Continuous data were summarized as means with standard deviations and compared using the t-test if distributed normally and Mann Whitney U test if skewed. The association between cervical dilatation at a definition of the onset of active labor and obstetric outcomes was evaluated by a test for fitness in relation to expected risks and the corresponding 95% confidence intervals. P-value < 0.05 was considered statistically significant. Data were analyzed using Statistical Package for Social Scientists Software version 25.

Results

Between January 1 and May 31, 2019, 203 parturients were screened for eligibility. Of these, 180 (88.7%) consenting parturients were enrolled (figure 1). The 23 (11.3%) were ineligible due to refusal to provide informed consent (n=12), twin gestations diagnosed during labor (n=3), newly diagnosis of HIV/AIDS (n=2), and withdrawal of consent (6). Of those enrolled, half (n=90) were at cervical dilation of 4 cm and the rest (n=90) at 6 cm of cervical dilatation.

The baseline sociodemographic and reproductive health characteristics are described in table 1. The mean age for parturients recruited at 4cm versus 6cm was similar at 25 (SD=5) years. Similarly, education level, employment status, parity, criteria for determination of gestation, state of membranes, number of living children, number of Ante-Natal Care (ANC) visits, and gestation in weeks were also comparable between the two groups.

Maternal and neonatal outcomes are presented in table 2. More parturients received oxytocin in the 4 cm (5) versus 6 cm (%) groups. Administration of oxytocin was 39% statistically significantly higher when active labor was defined at 4 cm compared to 6cm (RR 95% CI =1.39 (1.03-1.84), P=0.01). A higher proportion of parturients underwent amniotomy in the 4 cm vs the 6cm groups. The need for amniotomy was 54% statistically significantly greater when active labor was defined at 4cm compared to 6cm (RR 95% CI =1.54 (1.08-2.30), P=0.01). More vaginal examinations (VE) were performed among those recruited at 4 vs 6. Defining active labor at 4 cm was associated with statistically significantly higher average number of VE 4 (SD=1) compared to 6 cm 3 (SD=1), P<0.01). Although the risk of episiotomy was 18% lower when active labor was 4 cm (17.7%) compared to 6 cm (22.2%), this was not statistically significant. The risk of delivery via caesarian section was 19% higher when active labor was defined at 4 cm compared to 6 cm but this was not statistically significant P=0.308). Similarly, the risk of primary PPH was 31% higher, perineal tears were 9% lower when active labor was defined at 4 cm compared to 6 cm and these were not statistically significant. Neonatal outcomes when active labor starts at 4 cm versus 6 cm, show that the APGAR scores at 5- and 10-minutes P-0.802 and 0.875, were comparable when active labor was defined at 4 cm and 6 cm. The mean birth weight was higher when active labor was defined at 4 cm (3355 grams (SD=417 grams) compared to 6 cm (3310 grams (SD=464 grams). However, the results were statistically insignificant.

Discussion

In this, we found that parturients among whom active labor was defined at 4 cm had a significant P-value of 0.1 higher chances of risk of undergoing amniotomy. This finding is comparable to that by Onah et al., 2015 [13] in a randomized clinical trial found associations of early amniotomy compared to fetal membrane conservation reduced the duration of labor and need for oxytocin augmentation among term singleton pregnant women. Oxytocin was significantly the drug to choose with a P-value of 0.1 comparable

to Ajadi et al., 2006 [14], and was also complimented by Onah et al., 2015 [13]. Episiotomy in the study was also found statistically significant P-value of 0.1 lower when active labor was 4 cm (17.7%) compared to 6 cm in parturients though unknown or not common. In the study, vaginal examinations had a high impact and were statistically significant by a P-value less than 0.01, this is comparable to the findings by Shepherd A and Cheyne H, 2013 [15]. Moreover, the average number of vaginal examinations performed intrapartum was higher when active labor was defined as 4 cm compared to 6 cm cervical dilation. A cross-sectional study of 5167 women in India [16] reported similar results.

Definition of active labor as 4 cm compared to 6 cm cervical dilation was statistically not associated with a higher risk of caesarian deliveries. Incidences of caesarian section and their predisposing factors were not statistically significantly different when active labor was at 4 cm compared to 6 cm cervical dilation. Mikolajczyk et al. [17] reported a higher risk of cesarean deliveries before 4 cm cervical dilation, which reduced at 4 cm cervical dilation. In a study by Spong et al., in 2012, the high risk of cesarean deliveries during early labor was associated with failure of physicians to account for non- linearity of cervical dilation in early labor, as they expected the parameters of early cervical dilation to mimic those of late or optimal cervical dilation. When parameters of early labor clashed with the action lines of the partograph, cesarean deliveries were done even when uncalled for. This calls for an audit of the available clinical standards at KNH and design strategies that can improve the care offered by in- house obstetric staff during labor and delivery. We also recommend a review of the pre-existing labor assessment protocols of labor to improve decision-making on cesarean deliveries when active labor starts at 4 cm compared to 6 cm cervical dilatation.

Defining active labor at 4 cm compared to 6 cm cervical dilation was associated with an increased risk of intrapartum interventions. Administration of oxytocin and amniotomy was significantly statistically increased when active labor was defined at 4 cm cervical dilatation compared to 6 cm. In another cross-sectional study of 216 low-risk nulliparous parturients in Nepal [19], active labor defined at 4 cm cervical dilation had increased need for labor augmentation with oxytocin. Oxytocin is shown to restore cardiorespiratory homeostasis during labor and delivery, but close to 26.4% of its administration is done without a clear indication. Administration of oxytocin before 5cm dilatation might be inappropriate as it does not change the outcomes of labor as envisaged [18, 21]. During labor, parturients should be individualized after evaluation and interventions done with a clear indication.

Defining active labor at 4 cm compared to 6 cm cervical dilation was not associated with a statistically significant increase in the risk of adverse maternal and neonatal outcomes among term parturients. The risk of PPH, cervical and perineal tears was similar, while APGAR scores at 1, 5, and 10 minutes were normal and comparable when active labor was defined at 4 cm and 6 cm cervical dilation. A Cochrane review [22] reported similar results in 2018, in which cervical dilation was a poor predictor for birth outcomes, necessitating a review of the partograph alert time of 1 cm per hour. Degani and and Sikich [23] found no significant association between the arrest of labor at 6 cm dilation and associated complications in an evidence-based analysis in 2015. We propose a review of existing labor assessment protocols to improve decision-making for labor and delivery disorders.

Conclusions

Among term parturients, defining active labor at cervical dilatation of 6cm compared to 4cm had comparable obstetrics outcomes but reduced amniotomy, administration of oxytocin, and some vaginal examinations.

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Author contributions

O-AF, OO, OA, PA, and PM contributed to the design of the study. O- AF handled recruitment and data collection. O-AF, OO, OA, PA, and PM wrote and edited the manuscript.

Ethics declarations

Ethics approval

Ethical review and approval were obtained from the UoN/KNH Ethical Review Committees: number P749/10/2018, valid from 6th December 2018 to 5th December 2019.

Consent to participate

Participants provided informed consent before recruitment. Printed consent forms in English and Kiswahili were provided to parturients to read. Participants who could not read were read for verbatim by the research assistant in the presence of a next of kin before signing. Thumbprints were acceptable for illiterate participants. Parturients were free to withdraw from the study at any given point without prejudice. Moreover, the confidentiality of our participants was upheld during and after this study by de-identifying questionnaires. Signed consent forms and questionnaires were filed and stored in a lockable cabinet and databases password protected.

Consent for publication

Consent for publication was attained from study participants and collaborators. Competing interests
The authors have declared no non-financial or financial conflict of interest.

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8.6 Figure Legends

Figure 1. Flow chart showing the recruitment procedure of participant

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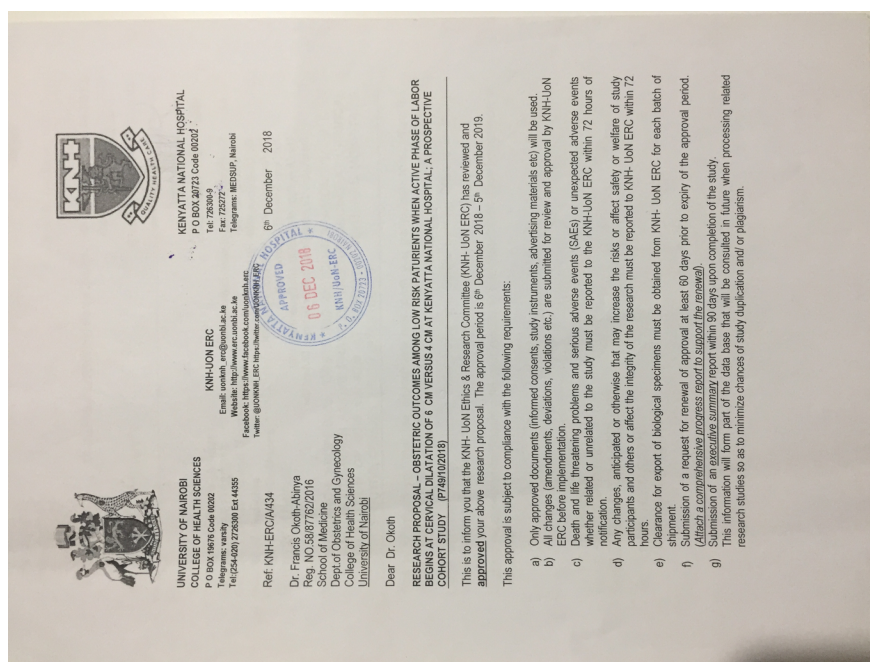
Table 1

		Cervical Dilation
Age in years	Mean (SD)	4cm (90)
Education	Primary	26 (5)
	Secondary	22 (24.4)
	Tertiary	38 (42.2)
Employment	Employed	30 (33.3)
	Unemployed	48 (53.3)
Parity	Primigravida	42 (46.7)
	Multigravida	39 (43.3)
Determination Gestation	Dates	51 (56.7)
	Scan	74 (82.2)
	Palpation	16 (17.8)
Status of Membrane	Absent	0 (0.0)
	Flat	18 (20.0)
	Bulging	59 (65.6)
Number of living Children	Mean (SD)	13 (14.4)
Number of ANC Visits	Mean (SD)	1 (1)
Gestational age in completed Weeks)	Mean (SD)	5 (2)
SD: Standard deviation, ANC: Antenatal clinic	*SD: Standard deviation, ANC: Antenatal clinic	*SD: Standard deviation, ANC: Antenatal clinic

Table 2

		Cervical Dilation	Cervical Dilation		
Oxytocin		4 cm (90)	6 cm (90)	RR (95% CI)	P-value
		38 (43.3)	24 (26.7)	1.39 (1.03-1.84)	0.01
Amniotomy		70 (77.8)	55 (61.1)	1.54 (1.08-2.30)	0.01
Episiotomy		15 (16.7)	20 (22.2)	0.82 (0.52-1.19)	0.34
Vaginal Examinations		4 (1)	3 (1)		<0.01
Mode of Delivery	Vaginal	76 (84.4)	80 (88.9)	Reference	
	Caesarian	14 (15.6)	10 (11.1)	1.19 (0.77-1.64)	0.308
Perineal Tears		42 (46.7)	38 (42.2)	1.09 (0.81-1.46)	0.549

		Cervical Dilation	Cervical Dilation		
Cervical Tears		4 (4.4)	0 (0.0)		
Post-Partum Hemorrhage (PPH)		9 (10.0)	5 (5.6)	1.31 (0.77-1.82)	0.266
APGAR Score after five minutes	(Mean (SD))	9 (1)	9 (1)		0.802
APGAR Score after ten minutes (Mean (SD))	APGAR Score after ten minutes (Mean (SD))	10 (1)	10 (1)		0.875
NBU admission		6 (6.7)	6 (6.7)		1.000
Bight Weight of Babies in grams (Mean (SD))	Bight Weight of Babies in grams (Mean (SD))	3355 (417)	3310 (464)		0.501



Hosted file

flow chart showing recruitment of participants.docx available at <https://authorea.com/users/726281/articles/708882-obstetric-outcomes-among-low-risk-parturients-when-active-phase-of-labor-is-defined-at-a-cervical-dilatation-of-6-versus-4-centimetres-at-kenyatta-national-hospital-kenya>