Maternal and Neonatal Outcomes in Low-Risk Women According to the Cervical Dilatation Defining Active Labor

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Abstract: Background: Labor is the physiological process by which the fetus and placenta are expelled from the uterus through the vaginal canal. Labor is influenced by maternal effort, uterine contractions, fetal characteristics, and pelvic anatomy. Management of normal labor involves monitoring maternal vitals, cervical progress, and labs, while minimizing interventions. Active labor, once defined at 4 cm dilation, is now considered to begin at 6 cm, impacting obstetric management and outcomes. Objectives: This study aims to compare maternal and neonatal outcomes, alongside labor interventions, when defining active labor onset at 4 cm versus 6 cm cervical dilation. Methods: A prospective case-control study was conducted at Al-Mawanee Teaching Hospital, Basrah, for the period from 1st of November 2024 to 30th of July 2025. Compared adverse obstetric outcomes in low-risk women admitted at 4 cm versus 6 cm cervical dilation. Eligible term, singleton, cephalic pregnancies were included, excluding medical disorders, fetal complications, inductions, and prior caesarean section. Data collection involved questionnaires, examinations, and monitoring of labor management, maternal complications, and neonatal outcomes. Results: This study compared outcomes among 200 women admitted in labor at 4 cm versus 6 cm cervical dilation. Significant differences included maternal age (older in 6 cm group, p=0.04) and parity (more nulliparas at 4 cm, p=0.003). Cervical consistency was softer in the 6 cm group (p=0.028), and fetal head station was more advanced (p=0.05). Women admitted at 4 cm had longer labor duration, longer amniotomy-to-delivery time, and higher oxytocin augmentation use (all p<0.001). Cesarean indications differed (p=0.032): fetal distress predominated at 6 cm, poor progress at 4 cm. maternal complications and neonatal outcomes showed no significant differences. Conclusion: Admission at 4 cm was linked to longer labor, more oxytocin use, and caesareans for poor progress, while 6 cm showed better readiness. Overall caesarean rates, maternal complications, and neonatal outcomes were similar.

Keywords: Obstetric, Low Risk, Parturients, Active Phase, Labor.

Introduction: Labor is the physiological process by which the fetus and placenta are expelled from the uterus through the vaginal canal. It is traditionally categorized into three distinct stages, with the first stage further subdivided into two phases. The progression of labor is influenced by three critical factors: maternal expulsive efforts and uterine contractions, fetal characteristics, and the maternal pelvic anatomy. These elements are collectively referred to as the power, passenger, and passage" triad (1-5).

To assess labor progression, healthcare providers utilize various monitoring techniques. Serial cervical examinations are performed to evaluate cervical dilation, effacement, and fetal station, which indicates the fetal position in relation to the maternal pelvis. The integration of these assessments allows clinicians to determine the stage of labor and ensure appropriate

management of labor progression (5-17)

Aim of the study

The primary objectives of this study are:

1. To compare maternal outcomes (e.g., duration of labor, mode of delivery, maternal morbidity) when the active phase of labor is defined at 4 cm versus 6 cm.

2. To evaluate neonatal outcomes (e.g., Apgar scores, neonatal intensive care unit admissions) under the two definitions.

3. To assess the overall impact of these definitions on labor interventions (e.g., augmentation, operative deliveries).

METHODS

A prospective case control study was conducted at the gynecological and Obstetrical Department at AlMawanee Teaching Hospital in Basrah City. To compare the incidence of adverse obstetric outcomes among low risk parturient when active labor starts at 4 cm compared to 6 cm dilatation. For the period from 1st of November 2024 to 30th of July 2025.

Low risk pregnant women whom presented with active stage of labor at a cervical dilation of 4cm or 6 cm to the labor ward at AlMawanee Teaching Hospital in Basrah were included in the study population.

Participants will be categorized into two groups based on cervical dilation at admission (4 cm or 6 cm).

Group One (Case): 100 women are regarded as being in active labor at 6 cm cervical dilation.

Group Two (Control): 100 women are regarded as being in active labor at 4 cm cervical dilation.

Inclusion criteria

• Singleton pregnancy.

• Term spontaneous labor (37-41weeks) gestation.

• Cephalic presentation.

Exclusion criteria

• Any history of chronic medical disorders such as cardiac disease, hypertension and DM, etc .

• Any fetal complications as fetal growth restriction or fetal anomalies.

• Pregnant women who underwent labor induction.

• History of uterine surgery, including previous CS.

• Those with Multiple pregnancies.

Approval to conduct the study was obtained from the University of Basrah, College of Medicine, and the Basrah Directorate of Health.

The participants were thoroughly informed about the study's purpose and significance, and verbal consent was secured before their enrollment.

Data were gathered from the participants through a structured questionnaire specifically designed for the study, as well as through direct interviews. The questionnaire covered the following areas: Socio-demographic characteristics: Age, place of residence, occupation. Pregnancy-related variables: Gravidity, parity, history of miscarriage, previous mode of delivery, and gestational age in weeks. Clinical profile: Assessment of the participants' past medical and surgical history on admission, each woman underwent a clinical examination to evaluate specific aspects. Anthropometric measurement: height, and BMI were calculated based on pre- pregnancy weight. Full systemic and obstetric examination had been conducted. Cervical dilatation was evaluated by the researcher herself.

This assessment was verified using a cervical dilation and effacement chart. Then the intrapartum management details were recorded and includes the following amniotomy, use of oxytocin infusion, the duration of the active phase and the mode of delivery (spontaneous vaginal delivery or cesarean section). The enrolled participants were subsequently monitored postpartum until discharge, and outcome data were collected. The adverse maternal outcomes had been recorded including cervical tears, primary postpartum hemorrhage (PPH), and early-onset sepsis. The neonatal outcomes includes the birth weight, Apgar score at 1 and 5 minutes, and admission to NICU.

Data entry was conducted using computerized statistical software, specifically the Statistical Package for Social Sciences (SPSS) version 26. Appropriate statistical tests were applied, with the Chi-square test used for categorical variables (Fisher's exact test applied when expected frequencies were less than 5) and independent t-tests utilized for continuous variables. A significance level (p-value) of ≤ 0.05 was considered for all statistical analyses.

RESULTS

Table 1: Demographic and Anthropometric Characteristics of Women Admitted at 4cm and 6 cm

cervical dilatation

Variables		6 cm cervical dilation (n=100)	4 cm cervical dilatation (n=100)	P- value
Age	Mean ± SD	27.57± 5.41	25.98± 5.28	0.04
Pre pregnancy weight	Mean ± SD	75.12± 9.8	75.69 ± 10.8	0.697
Height	Mean ± SD	163.68 ±5.48	164.42 ±5.89	0.747
BMI	Mean ± SD	28.18 ± 3.19	28.14 ± 3.24	0.933
	Normal	14 (14.0%)	15 (15.0%)	
	Overweight	52 (52.0%)	54 (54.0%)	
	Obese	34 (34.0%)	31 (31.0%)	
Parity	Nullipara	18 (18.0%)	26 (26.0%)	0.003
	1-4	76 (76.0%)	71 (71.0%)	
	>5	6 (6.0%)	3 (3.0%)	

There was a statistically significant difference in maternal age between the two groups, with women admitted at 6 cm having a slightly higher mean age (p = 0.04). No significant differences were observed between the groups regarding pre-pregnancy weight, height, or BMI. The distribution of BMI categories (normal, overweight, obese) was similar across both groups. A significant difference was found in parity (p = 0.003), with more nulliparous women in the 4 cm group and more grand multiparas (>5) in the 6 cm group.

Table 2: Obstetric and Cervical Assessment Findings at Admission

		Variables	6 cm cervical dilation (n=100)	4 cm cervical dilation (n=100)	p-value
	Gestational age (weeks)	Mean ± SD	38.42 ±0.94	38.5± 1.46	0.675
	Cervical effacement (%)	Mean ± SD	64.1± 7.5	62.58± 7.9	0.173
	Cervical consistency	Soft	48 (48.0%)	38 (38.0%)	0.028
		Medium	52 (52.0%)	57 (57.0%)	
		Firm	0 (0.0%)	5 (5.0%)	
	Station of the fetal head	-3	3 (3.0%)	0 (0.0%)	0.05
		-2	30 (30.0%)	26 (26.0%)	
		-1	32 (32.0%)	50 (50.0%)	
		0	29 (29.0%)	23 (23.0%)	
		1	4 (4.0%)	1 (1.0%)	
		2	2 (2.0%)	0 (0.0%)	
	Cervical position	Anterior	64 (64.0%)	57 (57.0%)	0.638
		Mid	33 (33.0%)	39 (39.0%)	
		Posterior	3 (3.0%)	4 (4.0%)	
	Membrane status	Intact	95 (95.0%)	93 (93.0%)	0.361

Table 2 shows Obstetric and Cervical Assessment Findings. The Gestational age, cervical effacement, cervical position, and membrane status were comparable between the two groups, with no statistically significant differences. Cervical consistency differed significantly (p = 0.028), with more women in

the 6 cm group having softer cervices and none classified as "firm." The fetal head station showed a borderline significant difference (p = 0.05), with more advanced station (+1 and +2) observed in the 6 cm group.

Table 3: Intrapartum intervention and Outcomes concerning Cervical Dilatation at Admission

Variables		6 cm cervical dilation (n=100)	4 cm cervical dilation (n=100)	p-value
Cervical dilatation at amniotomy (cm)	Mean ± SD	7.63± 56.4	5.40± 0.79	0.001
Duration from amniotomy to delivery (hour)	Mean ± SD	2.68 ±1.26	3.58 ±1.37	0.001
Oxytocin augmentation	Yes	61 (61.0%)	85 (85.0%)	0.001
	No	39 (39.0%)	15 (15.0%)	
Duration of labor (hour)	Mean ± SD	3.33 ±1.29	4.81±1.39	0.001
Mode of delivery	NVD	80 (80.0%)	77 (77.0%)	0.304
	CS	20 (20.0%)	23 (23.0%)	
Indication of CS	Fetal distress	12 (60.0%)	6 (26.1%)	0.032
	Poor progress	8 (40.0%)	17 (73.9%)	

Table 3 shows the Intrapartum Interventions and Outcomes. Cervical dilation at amniotomy was significantly higher in the 6 cm group (p = 0.001). Women admitted at 4 cm experienced significantly longer durations from amniotomy to delivery and overall labor duration (both p < 0.001). Oxytocin augmentation was more frequently required in the 4 cm group (85% vs. 61%, p < 0.001). No significant difference was found in the mode of delivery (NVD vs. CS) between the two groups (p = 0.304) , despite statistically non-significant difference in normal delivery rates between the two groups , the proportion of vaginal deliveries was slightly higher in the 6cm group compared to the 4cm group . Among cesarean sections, fetal distress was more common in the 6 cm group, while poor labor progress was more common in the 4 cm group (p = 0.032).

Table 4: Maternal Complications during Delivery among Women Admitted at 4 cm versus 6 cm Cervical Dilatation

Maternal complications during delivery	6 cm cervical dilation (n=100)	4 cm cervical dilation (n=100)	p-value
None	87 (87.0%)	85 (85.0%)	0.504
Vaginal tear	1 (1.0%)	2 (2.0%)	0.554
Perineal tear	5 (5.0%)	6 (6.0%)	0.742
PPH	6 (6.0%)	7 (7.0%)	0.758
Blood transfusion	1 (1.0%)	0 (0.0%)	0.681

Table 4 shows the maternal Complications during Delivery. No statistically significant differences were observed between the two groups regarding maternal complications such as vaginal or perineal tears, postpartum hemorrhage (PPH), or need for blood transfusion. Most of the women in both groups had no complications.

Table 5: Neonatal Outcomes Based on Cervical Dilatation at Admission

Neonatal outcomes		6 cm cervical dilation (n=100)	4 cm cervical dilation (n=100)	p-value
Neonatal status	Alive	100 (100.0)	99 (99.0)	0.316
	Dead	0 (0.0%)	1 (1.0%)	

Birth weight (Kg)	Mean ± SD	3.5± 3.28	3.44± 0.33	0.169
APGAR score at 1 minute	Mean ± SD	7.08± 1.17	6.95 ± 1.41	0.466
APGAR score at 5 minutes	Mean ± SD	9.61± 0.84	9.48 ± 1.18	0.409
NICU admission		17 (17.0%)	19 (19.0%)	0.688

Table 5 shows the Neonatal Outcomes. All neonates in the 6 cm group were alive at birth, compared to 99% in the 4 cm group; the neonatal death in the 4cm group was classified as an early neonatal death, occurring a few hours after birth, and was attributed to birth asphyxia that clinically confirmed by the attending senior pediatrician, though the difference was not statistically significant (p = 0.316). Birth weight and APGAR scores at 1 and 5 minutes were similar between the two groups, with no significant differences. NICU admission rates did not differ significantly between groups (p = 0.688).

DISCUSSION

The onset and definition of active labor remain key determinants in obstetric practice, guiding admission protocols, intrapartum management, and expectations regarding maternal and neonatal outcomes (18-22). Traditionally, the active phase of labor was defined as beginning at 4 cm cervical dilatation (23-31). However, contemporary evidence, including Zhang et al.'s re-evaluation of labor curves, has suggested that active labor may not reliably begin until 6 cm, with slower progression observed before this threshold (32). This redefinition has important clinical implications, as earlier admission may predispose women to unnecessary interventions, prolonged labor, and increased maternal exhaustion, without tangible benefits for maternal or neonatal outcomes (33). Thus, conducting research to compare obstetric outcomes between women admitted at 4 cm versus 6 cm cervical dilatation is of high clinical relevance, especially in low-resource settings where judicious use of interventions is crucial.

In the present study, maternal demographic characteristics were broadly comparable between the two groups, except for maternal age and parity. Women admitted at 6 cm were slightly older, and there was a higher proportion of grand multiparas, while nulliparity was more common in the 4 cm group. These findings align with physiological expectations, as multiparous women typically experience faster cervical dilatation and are more likely to present later in labor as reported by Lisonkova et al., (2017) and Ashwal et al. (2020) (34, 35).

With respect to cervical and obstetric parameters, cervical consistency and foetal head station differed between groups. Softer cervices and more advanced stations were more frequently observed in the 6 cm group, which is consistent with the natural progression of cervical ripening and descent of the presenting part. These findings strengthen the reliability of the data, as they reflect the expected physiological changes as labor advances (36), this agree with our study, which also demonstrate that greater cervical dilatation was associated with a softer cervix and lower fetal head station.

Intrapartum outcomes revealed more favorable labor progress in the 6 cm group. Women admitted at 4 cm experienced significantly longer durations of labor and more frequent need for oxytocin augmentation. This is consistent with the hypothesis of Miller et al. (2020) (37) that early admission may contribute to a cascade of interventions, as slower early labor progress is more likely to be perceived as dystocia (38). Interestingly, while the overall cesarean section rates did not differ between the groups, the indications did. Caesareans for poor labor progress predominated in the 4 cm group, whereas fetal distress was more common among the 6 cm group. This difference may reflect variations in labor dynamics, where earlier admission predisposes to intervention for protracted labor, while later admission may increase the likelihood of encountering intrapartum fetal compromise once labor is already advanced and these findings are in agreement with the findings from Dur-E-Shahwar et al. (2018)(39).

Maternal complications—including perineal trauma, postpartum haemorrhage, and blood transfusion—did not differ significantly between groups, suggesting that timing of admission did not adversely influence immediate maternal morbidity which is in agreement with the report from Myers et al. (2020). Similarly, neonatal outcomes, including Apgar scores, NICU admission, and perinatal survival, were not significantly different between groups, though one neonatal death due to birth asphyxia occurred in the 4 cm group which is in line with the findings from Daka et al. (2022) and Tavares et al. (2022) (40, 41). While this finding did not reach statistical significance, it warrants attention in larger-scale studies.

Our results are consistent with a growing body of

evidence supporting the redefinition of active labor onset at 6 cm. Zhang et al. (2010) reported that cervical dilatation from 4 to 6 cm progresses more slowly than previously believed, and treating 4 cm as active labor often leads to unnecessary augmentation. Similarly, Neal et al. (2010) and Mikolajczyk et al. (2016) demonstrated that admission at earlier dilatation was associated with longer labors and higher rates of augmentation without improvement in delivery outcomes (42, 43). The higher oxytocin uses and longer labor durations in the 4 cm group in our study corroborate these findings.

The absence of a difference in overall cesarean rates contrasts with the reports of (Kjerulff et al., 2017; and, Nedberg et al., 2016) (44, 45). Both of whom found that earlier admission was associated with an increased risk of oprative delivery. This discrepancy could be explained by the relatively low-risk population included in our study, the exclusion of inductions, and local practice patterns that may emphasize patience before surgical intervention. Nevertheless, the differing indications for cesarean between groups echo the findings of Vahratian et al. (2006), who noted that dystocia was a predominant indication among women admitted in early labor (46).

Taken together, these findings support the contemporary view that redefining active labor onset at 6 cm may reduce unnecessary interventions without adversely affecting maternal or neonatal outcomes. Earlier admission, particularly among nulliparas, appears to predispose to longer labors and increased reliance on oxytocin, perpetuating the "cascade of interventions" described in obstetric literature (47). Conversely, waiting until 6 cm before diagnosing active labor allows for more favorable cervical and fetal head conditions, which may facilitate smoother labor progress (3).

However, the observation that cesarean deliveries for fetal distress were more common in the 6 cm group warrants further exploration. It is possible that by the time women are admitted at more advanced dilatation, there is less opportunity for early detection and correction of evolving fetal compromise (42). This highlights the need for careful intrapartum monitoring and balanced clinical decision-making when adopting later admission thresholds.

CONCLUSION

Admission at 4 cm cervical dilatation is associated with significantly longer labor duration, increased oxytocin augmentation, and more cesarean sections due to poor labor progress compared with admission at 6 cm. Women admitted at 6 cm cervical dilatation had more favorable cervical consistency and fetal head station at admission, reflecting better physiological readiness for labor progression. The overall cesarean section rate did not differ significantly between groups; however, the indications varied, with poor progress predominating in the 4 cm group and fetal distress in the 6 cm group. Maternal complications such as perineal trauma, postpartum hemorrhage, and blood transfusion were comparable between the two groups, showing no adverse effect of admission timing. Neonatal outcomes—including Apgar scores, NICU admissions, and perinatal survival—did not significantly differ between groups, although a single neonatal death occurred in the 4 cm group.

Recommendations

After the current study, we recommend the following:

1. Adopt the definition of active labor starting at 6 cm cervical dilatation in low-risk women to avoid unnecessary interventions and prolonged labor.

2. Encourage delayed admission to labor wards until 6 cm dilatation, especially for nulliparous women, provided maternal and fetal conditions are reassuring.

3. Ensure rigorous intrapartum monitoring for women admitted at 6 cm, as the risk of fetal distress may be higher at this stage of labor progression.

4. Update obstetric staff and residents on modern labor progression standards (Zhang's curve) to reduce reliance on outdated 4 cm definitions of active labor.

5. Educate pregnant women during antenatal care about the benefits of later admission to labor wards and reassure them about the safety of waiting until 6 cm when appropriate.

Conduct larger, multicenter studies to validate these findings, particularly exploring the relationship between admission timing and fetal distress, and to assess long-term maternal and neonatal outcomes.

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