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Outcomes of the Primigravida with Engaged versus Unengaged Fetal Head at Term

Karishma Anjum Babar[1], Naila Bukhari[1], Saba Anjum Babar[1], Faryal Shah Pervez[1], Azra[1], and Seemab Amir[2*]

[1]Department of Obstetrics and Gynecology, Medical Teaching Institution, Khyber Teaching Hospital, Peshawar, Pakistan
[2]Department of Neonatal and Pediatric Surgery, Northwest General Hospital, Peshawar, Pakistan

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Corresponding Author:
Seemab Aamir
Department of Neonatal and Pediatric Surgery, Northwest General Hospital, Peshawar, Pakistan
seemabaamir@gmail.com

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ABSTRACT

Engagement of the fetal head within the pelvis is an important clinical indicator during pregnancy. Such evaluation guides obstetric decision-making and optimizes maternal and neonatal care. **Objectives:** To compare the frequency of outcomes in primigravida women with engaged and unengaged fetal heads at term. **Methods:** This prospective cohort study was carried out in the Department of Obstetrics and Gynecology, Khyber Teaching Hospital, Peshawar, from January 2025 to June 2025. A total of 126 primigravida women were recruited. Data were analyzed using SPSS version 22.0, and relative risk (RR) was calculated for both groups. **Results:** Among the 126 participants, the mean maternal age was 28.71 ± 6.80 years (range: 18–42 years). The mean birth weight in the engaged group was 3.07 kg. A significant association was observed between fetal head engagement and delivery mode. The unengaged group showed a markedly higher cesarean section rate (63%) compared with the engaged group (21%), with a relative risk of 2.93. **Conclusions:** Primigravida women with unengaged fetal heads at term had a significantly greater likelihood of cesarean delivery compared with those with engaged heads.

INTRODUCTION

In several of the most close-ended case studies, head engagement has been associated with labor induction among most women, especially primigravidae who are more likely to experience complications (e.g, Labor dystocia) during labor because they do not possess experience birthing [1]. Fetal head engagement is when the biparietal diameter of the fetal skull descends into the pelvic inlet of the mothers. It is clinically significant in indicating that the pelvis is adequate for vaginal delivery. Labor begins with a series of progressive changes, including cervical dilation, thinning of the cervix, coordinated uterine contractions, and the descent of the fetal head. A key feature of this process is engagement, which occurs when the biparietal diameter of the fetal head successfully enters the pelvic inlet. In primigravida women, engagement is generally observed around the 38th week of pregnancy, though it may take place anytime between 38–42 weeks or during the active phase of the first stage of labor [2]. Traditionally, one had the idea in obstetrics that head engagement before term is an essential prerequisite for vaginal delivery in primigravidas. According to recent articles and clinical observation, it is common for fetal heads to not engage at term, while there may still exist an opportunity for vaginal delivery [3]. Nonetheless, its absence remains an extremely important clinical red flag, particularly in low-resource settings, as it may indicate

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cephalopelvic disproportion (CPD), malposition, or mechanical obstruction caused by the placenta or uterine anomalies [4, 5]. In these cases, the chances of encountering an urgent labour with fetal distress or cesarean delivery are extremely high. Labor in primigravida women tends to be more challenging than in multiparas, as the uterus is less efficient, with relatively hypotonic contractions, which leads to a prolonged latent or first stage of labor [6]. Dystocia, defined as difficult or abnormal labor, is frequently encountered in primigravidas, affecting nearly 37% of them, and is a leading indication for cesarean section [7, 8]. Labor abnormalities in general account for approximately 20% of obstetric complications [9]. In the context of Pakistan, where the maternal mortality ratio remains high (276 per 100,000 live births), understanding preventable causes of labor complications such as prolonged latent phase, obstructed labor, and unnecessary cesarean sections is imperative [10]. Monitoring fetal head engagement as shown in Figure 1, during antenatal visits and at the onset of labor, is a simple yet effective tool to predict labor outcomes, especially in primigravida women, who are inherently at higher risk due to their physiological and psychological inexperience [11]. Several studies have identified a significant association between unengaged fetal heads and operative deliveries. Earlier studies found that fetal head station at the onset of labor directly influences labor outcomes, with higher rates of cesarean observed in unengaged cases [12-14]. The risk of sepsis, perinatal asphyxia, and maternal exhaustion also increases when labor is prolonged due to fetal non-engagement [15]. Previous researchers highlighted that the engaged fetal head is associated with shorter labor duration and higher spontaneous vaginal delivery (SVD) rates [12, 16]. Dall'Asta et al. emphasized the predictive value of intrapartum ultrasound in estimating successful vaginal delivery in nulliparous women during the second stage of labor [17], while Ludvigsen et al. reported that head station at full cervical dilation significantly impacts second-stage duration [3]. These findings reinforce the clinical utility of head station monitoring at various labor stages. This research fills a severe knowledge gap in the literature by offering local evidence of the role of fetal head engagement in influencing labor outcomes in primigravida women in their term in the Pakistani context. There has been no previous research on the fetomaternal implications of fetal head engagement in this particular cohort, especially in an area with a heterogeneous ethnic and socio-economic make-up. Moreover, the difference in local obstetric care practices also creates the need to conduct region-specific studies to be in a better position to inform the labor management strategies. Through the target population of the Khyber Pakhtunkhwa, the proposed study will serve an important gap in knowledge as well as provide valuable information on how primigravida women can be managed during term. The results will prove priceless to clinicians and policymakers in improving maternal and fetal care, minimizing unnecessary cesarean deliveries, and enhancing labor outcomes in our local setting.

Despite the recognized importance of fetal head engagement in predicting labor outcomes, there is limited local data assessing its direct impact on delivery mode among primigravida women in Pakistan. Most existing studies are conducted in high-resource settings, with different obstetric practices and demographic characteristics, leaving a gap in evidence relevant to our population. This lack of context-specific data makes it challenging to develop tailored labor management strategies for primigravidas in low-resource settings. This study aims to compare the frequency of outcomes in primigravida with engaged versus unengaged fetal head at term.

METHODS

This prospective cohort study was conducted in the Department of Obstetrics and Gynecology, Khyber Teaching Hospital, Peshawar, over six months (January to June 2025), following synopsis approval. Ethical clearance was obtained from the Khyber Medical College, Peshawar (Ref. No: 611/DME/KMC), and written informed consent was taken from all participants. A total of 126 primigravida women, aged 18–40 years with term singleton pregnancies, were enrolled through non-probability purposive sampling. The required sample size was calculated using WHO software, with parameters set at a 95% confidence level, a 5% margin of error, and an expected NICU admission frequency of 9% [18]. Participants were classified into two groups according to abdominal examination findings on admission. Group A included 80 women with an engaged fetal head (≤2/5 of the head palpable per abdomen), whereas Group B comprised 46 women with an unengaged head (5/5 of the head palpable above the pelvic brim relative to the ischial spines). To ensure consistency, all examinations were carried out by senior postgraduate residents using a uniform protocol, verified by a consultant obstetrician, and confirmed by ultrasonography to validate inter-observer agreement. Women with macrosomia (estimated fetal weight >4 kg), skeletal abnormalities, non-cephalic presentations, intrauterine growth restriction (IUGR), placenta previa, multiple gestations, intrauterine fetal demise, prior uterine surgery, or evidence of fetal distress on cardiotocography (CTG) were excluded. Baseline variables such as maternal age, weight, gestational age, height, and BMI were recorded, along with fetal weight and labor duration. Participants were observed

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until delivery. Cesarean section under spinal anesthesia was performed if there was failure to progress, fetal distress, or abnormal CTG; otherwise, spontaneous vaginal delivery (SVD) was allowed. Data collection was carried out using a structured proforma, and analysis was performed with SPSS version 22.0. Continuous variables such as age, BMI, and labor duration were summarized using mean and standard deviation, whereas categorical variables like mode of delivery were presented as frequencies and percentages. To examine the relationship between fetal head engagement and cesarean delivery, 2×2 contingency tables were applied, and relative risk (RR) was calculated. An RR greater than 1 was interpreted as indicating a clinically meaningful increase in risk. Additional analyses were conducted by stratifying the data according to maternal age, fetal weight, gestational age, BMI, and duration of labor, with RR values recalculated within each subgroup to assess the likelihood of cesarean delivery.

RESULTS

The study included 126 primigravida women aged 18–40 years; 80 had engaged and 46 unengaged heads. Mean age was 28.7 years, with no significant age difference between groups (p=0.412).

Table 1: Comparison of Engaged and Unengaged Groups

Variables	Group	N	Mean ± SD	p-Value
Gestational Age (weeks)	Engaged	80	38.9 ± 1.10	0.049
	Unengaged	46	39.3 ± 1.4	0.049
BMI (kg/m^2)	Engaged	80	22.8 ± 3.20	0.065
	Unengaged	46	21.60 ± 2.9	0.065
Fetal Weight (kg)	Engaged	80	3.1 ± 0.45	0. 031
	Unengaged	46	2.95 ± 0.42	0.031
Duration of Labor (hrs)	Engaged	80	10.2 ± 1.5	0.048
	Unengaged	46	10.8 ± 1.4	0.048

The mode of delivery showed a statistically significant association with fetal head engagement. Women in the Unengaged group had a substantially higher rate of cesarean section compared to the Engaged group (p-value < 0.001)(Table 2).

Table 2: The Mode of Delivery for Engaged and Unengaged

Group	Engaged (N=80)	Unengaged (N=46)	Total (N=126)	p-Value	RR (95% CI)
C-Section	17 (21.3%)	29 (63.0%)	46 (36.5%)	<0.001	2.93
SVD	63 (78.7%)	17 (37.0%)	80 (63.5%)	–	–
Total	80 (100%)	46 (100%)	126 (100%)	–	–

When analyzing the mode of delivery by age stratification, cesarean rates were notably higher in younger women. Among women aged ≤25 years, 17 (73.9%) in the Unengaged group underwent cesarean section compared to 4 (16.7%) in the Engaged group. This suggests that younger age may be associated with an increased likelihood of cesarean section in unengaged cases, with a significant relative risk. When delivery outcomes were analyzed in relation to gestational age and length of labor, a statistically significant association was observed across both groups, except among women with gestational age < 39 weeks, where the difference was not statistically significant. Cesarean rates increased substantially with advancing gestational age, especially in the unengaged group, where 91.3% of women with gestational age >40 weeks underwent cesarean section, compared to only 4.2% in the engaged group (Table 3).

Table 3: Stratifications of Delivery Throughout Labour and Gestational Age, Fetal Weight, and BMI

Variables	Engaged (N=80)	Unengaged (N=46)	p-Value	RR (95% CI)
Duration of Labor (Hours)				
<10	52 (65%)	22 (48%)	0.028	2.8
>10	28 (35%)	24 (52%)	<0.001	3.5 (1.7, 7.3)
Mode of Delivery (<10 hours)				
C-section	11 (21.2%)	16 (72.7%)	–	–
SVD	41 (78.8%)	6 (27.3%)	–	–
Mode of Delivery (>10 hours)				
C-section	6 (21.4%)	14 (58.3%)	–	–
SVD	22 (78.6%)	10 (41.7%)	–	–
Gestational Age (weeks)				
<39 weeks: C-section	16 (30.2%)	10 (43.5%)	–	–
<39 weeks: SVD	37 (69.8%)	13 (56.5%)	–	–
>40 weeks: C-section	1 (3.7%)	21 (91.3%)	–	–
>40 weeks: SVD	26 (96.3%)	2 (8.7%)	–	–
Fetal Weight (kg)				
<2.5	10 (12.5%)	8 (17.4%)	0.014	NA
>2.5	70 (87.5%)	38 (82.6%)	0.002	2.6 (1.4, 4.8)
Mode of Delivery by Fetal Weight				
<2.5 kg: C-section	0 (0%)	4 (50%)	–	–
<2.5 kg: SVD	10 (100%)	4 (50%)	–	–
>2.5 kg: C-section	17 (24.3%)	27 (71%)	–	–
>2.5 kg: SVD	53 (75.7%)	11 (29%)	–	–
BMI (kg/m^2)				
<25	66 (82.5%)	43 (93.5%)	–	2.85
>25	14 (17.5%)	3 (6.5%)	0.245	3.3 (0.9, 11.9)
Mode of Delivery by BMI				
<25: C-section	13 (19.7%)	28 (65.1%)	–	–
<25: SVD	53 (80.3%)	15 (34.9%)	–	–
>25: C-section	4 (28.6%)	2 (66.7%)	–	–
>25: SVD	10 (71.4%)	1 (33.3%)	–	–
<39 weeks: C-section	16 (32.0%)	10 (43.5%)	–	–
<39 weeks: SVD	37 (69.8%)	13 (56.5%)	–	–
39–40 weeks C-section	3 (10.0%)	4 (30.8%)	–	–
39–40 weeks SVD	27 (90.0%	9 (69.2%)	–	–
>40 weeks: C-section	1 (4.2%)	21 (91.3%)	–	–
>40 weeks: SVD	23 (95.82%)	2 (8.7%)	–	–

Similarly, labor duration played a critical role. In women with labor lasting more than 10 hours, the cesarean rate

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was significantly higher in the unengaged group (58.3%) compared to the engaged group (21.4%), indicating that prolonged labor is associated with increased surgical intervention, particularly in cases with unengaged fetal heads. Fetal weight also influenced delivery outcomes. Women with fetal weight greater than 2.5 kg had a markedly higher likelihood of cesarean section, especially in the unengaged group (71%) compared to the engaged group (24.3%). This reflects that fetal macrosomia, in the absence of engagement, increases the risk of surgical delivery. Likewise, BMI >25 kg/m^2 was associated with increased cesarean rates in both groups. In the unengaged group, 66.7% of women with higher BMI underwent cesarean section compared to 28.6% in the engaged group. Although the sample size in the higher BMI category was smaller, the trend suggests that maternal weight and fetal size are important predictors of delivery outcomes. These findings collectively highlight that fetal head engagement, labor duration, gestational age, fetal weight, and maternal BMI are all significant contributors to the mode of delivery in primigravida women at term.

DISCUSSION

In primigravida women, fetal head engagement typically occurs by 38 weeks of gestation, with the majority achieving full engagement either before or during the first stage of labor, particularly between 38 and 42 weeks [17]. A persistently high fetal head position near term may indicate cephalopelvic disproportion (CPD) or mechanical obstruction, such as placental location, both of which are associated with abnormal labor progression [3, 18]. Delayed engagement at the onset of active labor has been correlated with an increased risk of cesarean delivery [19]. In our study, labor duration exceeded in more than half of the women, with a higher proportion of prolonged labor in the Unengaged group. Prolonged labor in unengaged women was associated with maladaptation of the presenting part, high station at onset, deflexed fetal head, early rupture of membranes, misalignment of uterine contractions, and ineffective uterine activity. The mode of delivery showed a marked difference between groups, with women in the Engaged group having a significantly lower cesarean section rate compared to the Unengaged group. In our cohort, cesarean sections in the Engaged group were primarily due to poor progress of labor and fetal distress, while in the Unengaged group, the most common indication remained fetal distress. The observed mean fetal birth weight was 3.07 kg in the Engaged group, consistent with prior studies reporting averages of 3.0–3.2 kg [7]. Our findings of a higher proportion of prolonged labor in the Unengaged group support earlier evidence that primigravidas with unengaged heads experience longer latent and active phases of labor [20]. Contributing factors for prolonged labor in unengaged women, such as maladaptation of the presenting part, high station at onset, and deflexed fetal head, align with mechanisms proposed in previous studies. The lower cesarean section rate in the Engaged group is also consistent with prior research [21, 22]. The Unengaged group had a cesarean rate of 64.4%, higher than rates reported in other studies, possibly due to higher rates of induction or augmentation and differences in institutional surgical protocols [23]. This study underscores the importance of individualized labor management protocols in low-resource settings like Pakistan, where maternal mortality remains high. Regular training of healthcare providers in accurate abdominal examination and labor monitoring, combined with patient education and preparedness, can improve fetomaternal outcomes. Further multi-centered studies with larger cohorts and real-time intrapartum monitoring (e.g., ultrasound-based assessments) are recommended to validate these findings and refine risk stratification protocols for primigravida women with high fetal head stations. Overall, the rate of surgical intervention was significantly higher among primigravida women presenting with an unengaged fetal head at term, highlighting the predictive value of head engagement for labor outcomes.

This study is limited by its single-center design and relatively small sample size, which may affect the generalizability of the findings. Future research should involve multi-center studies with larger cohorts and incorporate real-time intrapartum tools such as ultrasound to assess fetal head engagement dynamically. Such studies could refine risk stratification and improve labor management protocols, ultimately reducing unnecessary cesarean deliveries and enhancing maternal and neonatal outcomes in local settings.

CONCLUSIONS

In conclusion, the likelihood of cesarean delivery is considerably greater among primigravida women presenting with an unengaged fetal head at term. Early identification of fetal head engagement during antenatal visits can help guide labor management and potentially reduce unnecessary cesarean deliveries.

Authors' Contribution

Conceptualization: KAB
Methodology: KAB, SAB, SA
Formal analysis: SAB, SA
Writing and Drafting: NB, SAB, FSP, A, SA
Review and Editing: NB, SAB, FSP, A, SA, KAB

All authors approved the final manuscript and take responsibility for the integrity of the work

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Conflicts of Interest

All the authors declare no conflict of interest.

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