Original Article

Association Between Maternal Height and Mode of Delivery Among Nulliparous Pregnant Women Delivered at Tertiary Care Hospital

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Abstract

Objective: To observe the impact of maternal height upon mode of delivery among nulliparous women. Maternal and neonatal morbidities are secondary aims associated with this study.

Methodology: This study is prospective observational study carried out at Department of Obstetrics and Gynaecology, Combined Military Hospital, Rawalpindi, from January 2024 to December 2024. A total of 350 pregnant women, with age range 20 years to 30 years selected who were admitted with labor pain in between 38 weeks to 40 weeks of gestation. Mode of delivery with different height of patient was obtained. Data was analyzed by using SPSS version 23 and p value of <0.05 was considered statically significant.

Results: The mean maternal age of patients is 25.06±5.07 years, with the majority (61.71%) having a height between 150–159 cm. , The percentage of normal vaginal delivery increases with increasing maternal height 51.3% (<150cm), 60.2% (150-159cm) and 74.7% (>159cm). The chi- square test indicates a statistically significant association between maternal height and the mode of delivery. The rate of caesarean section decreases with increasing maternal height, 38.5% (<150cm), 36.1% (150-159cm) and 23.2% (>159cm). Our study demonstrates the significant association between low maternal height (<150 cm) and increased likelihood of cesarean delivery (CD).

Conclusion: This study highlights the significant associations between maternal height and various delivery outcomes, emphasizing the need for further investigation into how these factors can influence clinical practices to improve maternal and neonatal health.

Keywords: maternal height, nullipara, caesarean delivery, obstetric surgical procedure.

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Introduction

Maternal height is one of the factors that affect the mode of delivery and labor duration in different females.[1] It can be seen through the findings of different studies in the extant literature that women who are shorter in height are more prone to end up in a cesarean section. The association of maternal height to the mode of delivery is attributed to smaller pelvises in women with shorter height.[2] Although cesarean section is one of the common mode of delivery (17% of all the deliveries around the globe are conducted through this procedure). However, the extant literature is full of studies and clinical findings that highlight the risk factors associated with the aforementioned mode of delivery.[1,3] Operative complications including excessive bleeding can occur in females who had undergone C-sections at rates varying from 6% for elective cesarean to 15% for emergency cesarean.[3] Moreover, caesarean

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sections can also require a recovery time that is longer than the recovery time of other modes of delivery. As seen in the statistics quoted above that 15% of females who had undergone a cesarean section are likely to develop complications, including but not limited to bleeding.[4] Hence, an emergency cesarean presents the patient with a much higher risk than the cesarean which has already been planned.

Understanding the relationship between height and modes of delivery can help in the prediction of the mode of delivery thus helping in the prevention of emergency cesarean. A gynecologist can use height as a measure to predict the mode of delivery and devise the delivery plan for female patients accordingly. The pre-planning can help in the prevention of maternal morbidity associated with complications related to the mode of delivery.[4] Caesarean birth is not a high-risk factor for the mother or the fetus if the delivery is in accordance with timely planning.[5] The repercussions associated with a late diagnosis not only include the risk of complications but also can be highly severe in underdeveloped or developing countries where caesarean services are limited.[6] Different studies in the existing literature concerned with the department of gynecology had found a significant impact of maternal height on cesarean section.

However, the threshold of the minimum height differs in different studies considering that factors such as ethnicity and age of the mother function as confounding variables to affect the relationship between maternal height and mode of delivery. The typical average height, in most studies, to predict caesarean is 160 cm.[7,8] The current study aims to access the impact of a maternal height and the mode of delivery. Other factors such as infant mortality, the health of the infants, and complications after labor are taken into account as a secondry outcome.

Methodology

According to WHO sample size calculator wherein by considering anticipated population proportion =P= 0.15 (15%) the sample size comes to 307. This is a prospective observational study was carried out at Combined Military Hospital Rawalpindi during 1st January 2024 to 31st December 2024. After obtaining ethical approval, questioner was designed and pregnant women who were admitted in labor room with following criteria were included in study.

The study included female patients age ranges from 20 years to 30 years who had first pregnancy of gestational age ranges between 38 weeks to 40 weeks with labour pains. While patients with any medical disorder, obstetrical cause for absolute indication for caesarean section like breech presentation, placenta previa, birth canal obstruction were excluded. Patients with pregnancy with fibroid or ovarian cyst, twin pregnancy, intrauterine fetal demise and good size baby (weighing more than 4 kg at term gestation) were also excluded. All the baseline clinical characteristics including gestational age, maternal height, method of conception, the onset of labor, mode of delivery, and maternal and neonatal morbidity were taken into consideration.

The gathered patients' data were analyzed and evaluated through SPSS Version 23. Descriptive statistics were calculated for all variables. Chai square test and Student t test were used for qualitative and quantitative variables accordingly The level of significance was also determined by using a 95% confidence interval and p value of <0.05 was considered statistically significant.

Results

A total of 350 patients were included in this study, with their demographic and clinical characteristics summarized in Table I. The mean maternal age of the participants was 25 years and 01 month, with a standard deviation of 5.07 years (25.06 ± 5.07). The majority of patients (61.71%) had maternal heights ranging from 150 to 159 cm, totaling 216 individuals in this category. The overall mean maternal height was 163.09 cm, while the mean gestational age was recorded as 38 weeks and 05 days (38.71 ± 1.10 days). Furthermore, the socioeconomic status of the patients indicated that 47.43% belonged to the low socioeconomic group, compared to 45.71% classified as middle socioeconomic status.

The clinical parameters related to maternal and neonatal outcomes are summarized in Table 2. Among the participants, a spontaneous method of conception was utilized by 315 patients(90.00%), with labor onset predominantly 219 (62.57%) compared to induced 131(37.43%). The preferred mode of delivery was normal vaginal delivery (NVD), experienced by 221 patients (63.14%), while 115 patients (32.86%) underwent caesarean section. Notably, the majority of neonatal outcomes were favourable, with 348 babies (99.43%) reported as alive, and only 2 babies (0.57%) recorded

as deceased. The majority of neonatal birth weights fell within the range of 2.5 to 2.9 kg, accounting for 165 infants (47.14%), while 136 infants (38.86%) had birth weights between 3.0 and 3.5 kg. Furthermore, maternal morbidity was low, with 319 mothers (91.14%) reporting no complications, and 307 neonates (87.71%) showing no signs of morbidity.

Table I: Demographic and Clinical Characteristics of Participants

Variables	N	(%)
Maternal Age	25 years & 01 month	
Mean Maternal Age	(25.06 ± 5.07)	
Maternal Height		
< 150 cm	39	11.14%
150-159 cm	216	61.71%
> 159 cm	95	27.14%
Maternal Weight	63.09 Kg	
Mean Maternal Weight	(63.09 ± 10.42)	
Gestational Age	38 weeks & 05 days	
	(38.71 ± 1.10)	
Socioeconomic Status		
Low Middle	166	47.43%
Upper	160	45.71%
	24	6.86%

Table II: Clinical Parameters and Outcomes of Participants.

Variables	**n**	**(%)**
Method of Conception		
Induction of Ovulation	35	10.00%
Spontaneous	315	90.00%
Onset of Labour		
Induced	131	37.43%
Spontaneous	219	62.57%
Mode of Delivery		
Normal Vaginal Delivery (NVD)	221	63.14%
Instrumental	14	4.00%
C-Section	115	32.86%
Baby Outcome		
Alive	348	99.43%
Dead	2	0.57%
Birth Weight		
< 2.5 kg	2	0.57%
2.5-2.9 kg	165	47.14%
3.0-3.5 kg	136	38.86%
> 3.5 kg	24	6.86%
Maternal Morbidity		
Cervical Tear	2	0.57%
Epi/Stitch Infection	1	0.29%
Perineal Tear	2	0.57%
Prolonged Hospitalization	1	0.29%
Transfusion	4	1.14%
Uterine Atony	2	0.57%
No Morbidity	319	91.14%
Neonatal Morbidity		
Admission in NICU	31	8.86%

In our analysis, as shown in Table III, the percentage of NVD increases with maternal height 51.3% (<150cm), 60.2% (150-159cm) and 74.7% (>159cm). The chi-square test indicates a statistically significant association between maternal height and the mode of delivery. Cramer`s V (0.13) suggests a moderate effect size. The p-value (0.027) confirms the observed differences are statistically significant. The percentage of instrumental deliveries is relatively low across all height categories: 10.3%(<150cm), 3.7% (150-159cm) and 2.1% (>159cm). Caesarean section decreases with increasing maternal height maternal height: 38.5% (<150cm), 36.1%(150-159cm) and 23.2% (>159cm).

To evaluate the effect of various clinical parameters on maternal height, hypothesis testing revealed that the method of conception significantly influences maternal height (p-value=0.009), indicating a dependent relationship between the two variables. In contrast, the onset of labor does not significantly affect maternal height (p-value=0.542), suggesting independence. Similarly, the mode of delivery is significantly associated with maternal height (p-value=0.027), reinforcing their dependence. Additionally, birth weight demonstrates a significant effect on maternal height (p-value=0.042), while both maternal morbidity (p-value=0.002) and neonatal morbidity (p- value=0.003) and also show significant associations with maternal height, indicating dependent relationships.

In our study, maternal height was categorized into three distinct groups: <150 cm, 150-159 cm, and >159 cm, making it applicable for daily clinical practice. The shortest group (<150 cm) represents women below the fifth percentile of height.

The multivariate logistic regression analysis, as shown in Table IV, demonstrates that low maternal height (<150 cm) is significantly associated with an increased likelihood of caesarean delivery (CD), as well as composite maternal and neonatal morbidity. The adjusted odds ratio (OR) for CD in women with maternal height <150 cm was 2.001 (95% CI, 1.162-3.446), indicating a significant increase in risk. In contrast, for women with heights between 150–159 cm, the OR was 2.667 for CI 0.7412, Suggesting a higher risk, though this result was not statistically significant. For women with heights ≥159 cm, the OR was 0.678 (95% CI, 0.422-1.089), indicating a lower likelihood of CD, though the association was also not statistically significant.

Table III: Comparison of Different Clinical Parameters for Each Category of Maternal Height.						
Maternal Height (cm)	**<150 (n=39) (%)**	**150-159 (n=216) (%)**	**>159 (n=95) (%)**	**χ2**	**Cramer V**	**p-value**
Method of Conception						
Induction of Ovulation	3 (7.7)	29 (13.4)	3 (3.2)	.99	.15	0.009**
Spontaneous	36 (92.3)	187 (86.6)	92 (96.8)			
Onset of Labour						
Induced	17 (43.6)	82 (38.0)	32 (33.7)	.23	.06	0.542
Spontaneous	22 (56.4)	134 (62.0)	63 (66.3)			
Mode of Delivery						
NVD	20 (51.3)	130 (60.2)	71 (74.7)	.70	.13	0.027*
Instrumental	4 (10.3)	8 (3.7)	2 (2.1)			
C-Section	15 (38.5)	78 (36.1)	22 (23.2)			
Baby Outcome						
Alive	39 (100)	214 (99.1)	95 (100)	1.25	.06	0.380
Dead	0	2 (0.9)	0			
Birth Weight						
<2.5 kg	2 (5.1)	16 (7.4)	7 (7.4)	13.07	.14	0.042*
2.6-2.9 kg	19 (48.7)	111 (51.4)	35 (36.8)			
3.0-3.5 kg	17 (43.6)	79 (36.6)	40 (42.1)			
>3.6 kg	1 (2.6)	10 (4.6)	13 (13.7)			
Maternal Morbidity						
Cervical Tear	0	0	2 (2.1)	30.62	.30	0.002**
Epi/Stitch Infection	0	2 (0.9)	0			
Perineal Tear	2 (5.1)	0	4 (4.2)			
Prolonged Hospitalization	0	2 (0.9)	0			
Transfusion	3 (7.7)	12 (5.6)	0			
Uterine Atony	2 (5.1)	2 (0.9)	0			
No Morbidity	32 (82.1)	198 (91.7)	89 (93.7)			
Neonatal Morbidity						
Admission in NICU	7 (17.9)	25 (11.6)	8 (8.4)	19.46	.24	0.003**
Distress	2 (5.1)	0	0			
Trauma to Baby	0	1 (0.5)	0			
No Morbidity	30 (76.9)	190 (88)	87 (91.6)			

Discussion

Height of a female is associated with their pelvic size10. Different studies in the medical literature states that different factors play a role in the mode of delivery of a child.[10,11] One of such factors is maternal height which is taken as an independent variable of our study. The dependent variables include mode of delivery and maternal and fetal morbidity. The current literature has rare findings on the contribution of maternal height towards morbidity of the mother and the fetus. Our study has expanded from the previous literature by bringing into account factors such as maternal and fetal morbidity, and fetal mortality.[12,13, 14] Our study found a positive link between maternal height and mode of delivery, which is supported by the data in the extant literature. In one study Rozina et al compared different height of female with different outcome of deliveries,

Table IV: Multivariate Logistic Analysis of Adjusted Odds Ratios for Maternal and Neonatal Morbidity by Mode of Delivery						
2Mode of Delivery	**< 150 (n=39) Adjusted OR (95% CI)**	**p-value**	**150-159 (n=216) Adjusted OR (95% CI)**	**p-value**	**> 159 (n=95) Adjusted OR (95% CI)**	**p-value**
Instrumental C-Section	0.500 (0.290-0.861)	0.012	2.840 (0.619-13.029)	0.179	4.02 (1.155-13.993)	0.108
Composite Maternal Morbidity	0.249 (0.071-0.866)	0.029	1.476 (0.918-2.371)	0.133	1.581(0.512-4.887)	0.426
Composite Neonatal Morbidity	2.001 (1.162-3.446)	0.012	2.667 (0.741-9.593)	0.145	0.678(0.422-1.089)	0.145
Maternal Morbidity	0.738 (0.582-0.936)	0.012	1.355 (1.068-1.719)	0.013	1.208(0.937-1.557)	0.145
Neonatal Morbidity	0.528 (0.328-0.850)	0.009	1.561 (1.075-2.267)	0.019	1.894(1.177-3.050)	0.008

where she observed that shorter females (<145cm) had inadequate pelvis as compared to female height between 151-155 cm and vaginal deliveries are less than female having height between 151-155cm.[16] Moreover, a significant link is also found between morbidity of both mother and child and maternal height. The prediction can enable the healthcare system to improve the patients' outcomes14. In a clinical setting, where height can be used to analyze the mode of delivery, risks associated with sudden cesarean can be avoided.[15, 16]

In two studies carried out at Japan and United states of America found significant inverse relationship between maternal height and occurrence of caesarean deliveries.[16,17]

According to them shorter women were more prone to deliver via caesarean section than vaginal or operative vaginal deliveries.[16, 17] Our study also reveals the significant link between maternal height and birth weight. The more the height of pregnant woman, the higher birth weight are observed. Similar results are seen in the study of Japan and Sweden.[16,19] One study suggested the increase of fetal birthweight about 17 gm with increase of every 1 cm of maternal height.[20] Similarly, a Saudi study observed 12.8 gm of increased birth weight with 1 cm increase of maternal height.[21] These findings enabled the gynecologists and other medical personnel to use the variables as tools for predictive analysis of cesarean section and associated morbidities.

Conclusion

In conclusion, this study highlights that maternal height is significantly associated with the mode of delivery associated with the mode of delivery. Women with greater height are more likely to have a normal vaginal delivery, while those with shorter stature are more likely to undergo caesarean section .The findings imply that maternal height may be an important factor in determining the likelihood of a successful vaginal delivery. Healthcare providers should consider maternal height when assessing the risk of complication during delivery and making informed decision about the mode of delivery.

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Limitation: This current study was conducted in a single hospital in a specific region of Pakistan. This was not a multi-centered study and the context of the current study included a limited ethnicity. There is a need to study association of different height of a particular ethinicity with mode of delivery to anticipate the need of urgent caesarean section or operative vaginal deliveries.

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