Maternal Height and the Risk of Cesarean Delivery in Nulliparous Women

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Objectives: *To evaluate the relationship between maternal height of < 155 cm and the risk of caesarean delivery due to cephalo-pelvic disproportion (CPD) among nulliparous women.*
Design: *Retrospective cohort study*
Material and Method: *A total of 660 term (GA ≥ 37 weeks), uncomplicated singleton nulliparous pregnant women were enrolled on admission to labour room. The patients were divided into two groups based on maternal height, ≥ 155 cm (440 cases) as control and < 155 cm (220 cases) as study group. The medical records of these women were reviewed. Various baseline clinical characteristics were collected. Intrapartum characteristics and maternal and neonatal outcomes were recorded.*
Results: *The rate of caesarean section of all indications was only slightly higher among study group than control group (16.4% and 13.7% respectively, p = 0.514). No significant difference was observed in the rate of caesarean delivery due to CPD (7.3% and 10.5% in control and study group respectively, p = 0.376). The rate of caesarean delivery due to CPD was highest among those with height < 150 cm (p < 0.001). Mean birth weight was significantly lower among study group than control group (2,927.7 ± 368.1 g and 3,068.4 ± 358.5 g respectively, p < 0.001). Low birth weight (< 2,500 g) was significantly higher among study group than control group (10.9% and 3.2% respectively, p < 0.001).*
Conclusion: *Term singleton nulliparous pregnant women with maternal height < 155 cm were not associated with a greater likelihood of caesarean section for CPD. However, mean birth weight was significantly lower and low birth weight was significantly increased among mothers with short stature.*

Keywords: *Maternal height, Cesarean delivery, Cephalo-pelvic disproportion (CPD)*

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The diagnosis of cephalopelvic disproportion (CPD) was often used when labour progression is not sufficient. CPD can rarely be diagnosed with certainty before labour begins, the relatively imprecise term "failure to progress" has been used, which includes lack of progressive cervical dilatation or lack of descent of fetal head or both. The diagnosis of dystocia should not be made before an adequate trial of labour has been achieved. CPD was common in both developed and developing country. Obstructed labour remains one of the most important causes of maternal mortality in developing countries and CPD is the leading cause of both operative vaginal delivery and caesarean delivery and their accompanying complications[1,2].

The relationship between maternal height and the risk for CPD were diversely appreciated. Numbers of studies[3-11] have reported correlation between maternal height and assisted delivery, i.e. forceps extraction, caesarean section, while others[12-14] failed to find such correlation. Maternal height, which is easy to measure, has been reported to be a useful tool to predict difficult childbirth and CPD[7]. Maternal height of < 155 cm has been reported as an obstetric risk factor for dystocia due to CPD, and thus for caesarean section[3,7,15-17]. In addition, several studies found maternal short stature to be associated with adverse perinatal outcomes

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including low birth weight and neonatal asphyxia[16,18].

The present study was aimed to evaluate the relationship between maternal height of < 155 cm and the risk of caesarean delivery due to CPD among nulliparous women. In addition, pregnancy outcomes were also evaluated.

Material and Method

A retrospective cohort study was conducted at Siriraj Hospital with the approval of the Institutional Ethic Committee. A total of 660 term (GA ≥ 37 weeks), uncomplicated singleton nulliparous pregnant women between July – October 2004 were enrolled on admission to labour room. The patients were divided into two groups, i.e. 440 mothers with height of ≥ 155 cm (Control group) and 220 mothers with height of < 155 cm (Study group). Controls were randomly selected from pregnant women who admitted in the same day as women in study group in the ratio of 2:1.

Exclusion criteria included pregnancy with medical or obstetric complications, those with non-vertex presentation of the fetus, those with fetal anomaly or fetal death, and those who were indicated for elective caesarean section, e.g., placenta previa, previous uterine scar.

The medical records of these pregnant women were reviewed. Various baseline clinical characteristics were collected. Intrapartum and maternal and neonatal outcomes were recorded. CPD was defined as little or failure to progress of labour over a 2-4 hours period with good uterine contraction and cervix dilated to at least 3-4 cm[2,19].

Univariate analysis was used to compare various characteristics between the two groups, either by Chi-square test or Student's t test as appropriate. P value of less than 0.05 was considered statistical significance.

Results

During the study period, a total of 660 nulliparous pregnant women who met the criteria, were enrolled: 220 in study group and 440 in the control group.

Table 1 shows comparison of baseline characteristics between the two groups. Both groups were comparable with regard to age, gestational age, and antenatal care.

Table 2 shows comparison of intrapartum characteristics between the two groups. The rate of oxytocin-use was not significantly different between the two groups. However, the rate of spontaneous rupture of membranes was significantly higher among study group than in control group (37.3% and 22.3% respectively, $p < 0.001$). Amniotic fluid characteristics were also comparable between the two groups. The rate of caesarean section of all indications was only slightly higher among study group than control group (16.4% and 13.7% respectively, $p = 0.514$).

Table 3 shows comparison of the route of delivery between the two groups when caesarean section was stratified by its indication. No significant difference was observed in the rate of caesarean delivery due to CPD (7.3% and 10.5% in control and study group respectively, $p = 0.376$).

Comparison of neonatal characteristics was shown in Table 4. Mean birth weight was significantly lower in the study group than in the control group (2927.7 ± 368.1 and 3068.4 ± 358.5 respectively, $p < 0.001$). Low birth weight (< 2500 g) was significantly higher among study group than those in the control group (10.9% and 3.2% respectively, $p < 0.001$). No birth asphyxia (Apgar score at 5 min < 7) was observed in both groups.

When maternal height was reclassified in to 3 groups; < 150 cm, 150-159 cm, and ≥ 160 cm, significant differences in caesarean delivery due to CPD were observed as shown in Table 5. The rate of caesarean delivery due to CPD was highest among those with height < 150 cm while the rates in the other 2 groups were comparable ($p < 0.001$).

Discussion

Maternal height, which is easy to measure, has been reported to be a useful tool to predict difficult

Table 1. Baseline characteristics of pregnant women

Characteristics	Control group (n = 440)	Study group (n = 220)	p-value
Mean age ± SD (years)	26.33 ± 4.93	26.36 ± 5.43	0.948
Mean gestational age ± SD (weeks)	39.06 ± 1.26	38.94 ± 1.27	0.225
ANC			0.108
Yes	430 (97.7%)	210 (95.5%)	
No	10 (2.3%)	10 (4.5%)	

Table 2. Intrapartum characteristics of pregnant women

Intrapartum characteristics	Control group (n = 440)	Study group (n = 220)	p-value
Oxytocin use			
Yes	314 (71.4%)	164 (74.5%)	0.407
No	126 (28.6%)	56 (25.5%)	
Membranes rupture			
Spontaneous	98 (22.3%)	82 (37.3%)	<0.001
Artificial	342 (77.7%)	138 (62.7%)	
Amniotic fluid			
Clear	324 (73.6%)	178 (80.9%)	0.119
Meconium-stained	88 (20.0%)	32 (14.6%)	
Undetermined	28 (6.4%)	10 (4.5%)	
Type of delivery			
Spontaneous delivery	349 (79.3%)	174 (79.1%)	0.514
Vacuum / Forceps extraction	31 (7.0%)	10 (4.5%)	
Cesarean section	60 (13.7%)	36 (16.4%)	

Table 3. Route of delivery

Route of delivery	Control group (n = 440)	Study group (n = 220)	p-value
Route of delivery			0.376
Vaginal delivery	380 (86.3%)	184 (83.6%)	
Cesarean section due to CPD	32 (7.3%)	23 (10.5%)	
Cesarean section due to other indications	28 (6.4%)	13 (5.9%)	

Other indications included fetal distress, thick meconium stained fluid, prolapsed cord, failed induction, acute chorioamnionitis

Table 4. Neonatal outcomes

Neonatal outcomes	Control group (n = 440)	Study group (n = 220)	p-value
Mean birth weight $\pm$ SD (g)	3068.4 $\pm$ 358.5	2927.7 $\pm$ 368.1	<0.001
Low birth weight (<2500 g)	14 (3.2%)	24 (10.9%)	<0.001
Gender of infant			0.741
Male	220 (50%)	113 (51.4%)	
Female	220 (50%)	107 (48.6%)	

Table 5. Rate of cesarean section due to CPD among different maternal height

Maternal height	Rate of cesarean section due to CPDN/Total (%)	p-value
< 150 cm	8/54 (14.8%)	<0.001
150-159 cm	39/426 (9.2%)	
$\geq$ 160 cm	55/227 (8.3%)	

childbirth and CPD[7]. Previous studies have reported that maternal short stature was an independent risk factor for caesarean delivery regardless of its association to dystocia, a major cause for caesarean delivery among short parturient women[3,7,15-18,20,21]. However, different cut-off points were used ranging from 152 to 155 cm. In our study, no significant association was observed between maternal short stature (< 155 cm) and the rate of caesarean section due to CPD. Only slightly higher rate was observed among short stature

mother (7.3% and 10.5% in control and study groups respectively). The result was similar to other studies that also failed to find such correlation[12-14]. But when maternal height was reclassified, we found that cesarean section rates due to CPD increased significantly among women who were < 150 cm tall. Therefore different cut off point should be considered in assessing the risk of CPD. Previously reported cut off of 155 cm is from a different population that might not be appropriate for Thai women.

Some previous studies have also reported that some adverse perinatal outcomes were associated with maternal short stature, including low birth weight and neonatal asphyxia[16,18]. In this study, significantly lower mean birth weight among mothers with short stature has been observed but might be without clinical significance (difference of 140 g). In addition, low birth weight was also significantly increased among mothers with short stature. This might be due to difference in size of the mothers in 2 groups that affected size of the newborn. Moreover, short stature mothers might be from poorer social class and had an unhealthy family and past history and might result in poorer overall health that could affect infant's birth weight. However, no birth asphyxia was found in any newborn.

The limitation of our study included minor errors that are inevitable due to the nature of retrospective data. Some information might not be accurate and some mothers might be misclassified due to inaccuracy of their recorded height. However, such errors should only be minimal. In addition, we did not know if mothers who underwent caesarean section from other indications than CPD actually had CPD or not since caesarean section could have taken place before CPD could be diagnosed. In addition, data on other factors related to CPD such as pelvimetry, body mass index (BMI) were not available.

Further prospective studies should be performed in order to make an informed recommendation regarding the preferred mode of delivery in short parturient women. Because the likelihood of having a normal vaginal delivery was still very good, maternal height alone should not affect the management of labour and decision on route of delivery. However the combination of other risk factors with maternal height may be of more clinical use in the management and decision-making process of labouring women.

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ความสูงของมารดากับความเสี่ยงต่อการผ่าตัดคลอดในหญิงตั้งครรภ์ที่ไม่เคยคลอดบุตร

นันทอร วงศ์เจริญเกียรติ, ดิฐกานต์ บริบูรณ์หิรัญสาร

วัตถุประสงค์: *เพื่อเปรียบเทียบความสัมพันธ์ระหว่างความสูงของมารดากับความเสี่ยงต่อการผ่าตัดคลอดเนื่องจากขนาดศีรษะทารกไม่ได้สัดส่วนกับอุ้งเชิงกราน ในหญิงตั้งครรภ์ที่ไม่เคยคลอดบุตร*

ชนิดของการวิจัย: *การวิจัยแบบ Retrospective Cohort*

วัสดุและวิธีการ: *ทบทวนเวชระเบียนของหญิงตั้งครรภ์เดี่ยวครบกำหนด (อายุครรภ์ตั้งแต่ 37 สัปดาห์ขึ้นไป) ที่ไม่เคยคลอดบุตร ที่มาคลอดที่ห้องคลอดสามัญ จำนวน 660 คน โดยแบ่งเป็น 2 กลุ่ม ได้แก่ หญิงตั้งครรภ์ที่มีความสูงน้อยกว่า 155 ซม. จำนวน 220 คน และหญิงตั้งครรภ์ที่มีความสูงตั้งแต่ 155 ซม.ขึ้นไป จำนวน 440 คน (กลุ่มศึกษาและกลุ่มควบคุมตามลำดับ) ทำการรวบรวมข้อมูลต่าง ๆ เกี่ยวกับ ข้อมูลทั่วไป ข้อมูลการคลอด ผลการคลอด และบันทึกข้อมูลในแบบ บันทึกข้อมูลที่จัดทำขึ้น จากนั้นจึงนำข้อมูลที่ได้ไปวิเคราะห์*

ผลการศึกษา: *พบว่าอัตราการผ่าตัดคลอดบุตรทั้งหมดในกลุ่มศึกษามีอัตราสูงขึ้นเพียงเล็กน้อยเมื่อเทียบกับกลุ่มควบคุม (16.4% และ 13.7%, ค่าพี = 0.514) เมื่อศึกษาอัตราการผ่าตัดคลอดบุตรเนื่องจากขนาดศีรษะทารกไม่ได้สัดส่วนกับอุ้งเชิงกรานพบว่า ไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติในกลุ่มควบคุมและกลุ่มศึกษา (7.3% และ 10.5%, ค่าพี = 0.376) โดยพบว่าอัตราการผ่าตัดคลอดบุตรเนื่องจากขนาดศีรษะทารกไม่ได้สัดส่วนกับอุ้งเชิงกรานเพิ่มสูงอย่างมีนัยสำคัญทางสถิติในหญิงตั้งครรภ์ที่มีความสูงน้อยกว่า 150 ซม. (ค่าพี < 0.001) ในกลุ่มศึกษามีน้ำหนักทารกแรกเกิดเฉลี่ยน้อยกว่ากลุ่มควบคุม (2,927.7 ± 368.1 กรัม และ 3,068.4 ± 358.5 กรัม, ค่าพี < 0.001) และมีทารกน้ำหนักแรกเกิดต่ำกว่า 2,500 กรัม สูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ (10.9% และ 3.2%, ค่าพี < 0.001)*

สรุป: *หญิงตั้งครรภ์เดี่ยวที่อายุครรภ์ครบกำหนดที่ไม่เคยผ่านการคลอดบุตร ที่มีความสูงน้อยกว่า 155 ซม. ไม่เพิ่มอัตราเสี่ยงในการผ่าตัดคลอดบุตรเนื่องจากขนาดศีรษะทารกไม่ได้สัดส่วนกับอุ้งเชิงกราน แต่มีค่าเฉลี่ยน้ำหนักทารกแรกเกิดน้อยกว่า และมีทารกที่น้ำหนักแรกเกิดน้อยกว่า 2,500 กรัมมากกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ*