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The Association between Obesity and the Risk of Cesarean Delivery and other Adverse Pregnancy Outcomes in Singleton Term Pregnancies

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ABSTRACT

Objective To compare the risk of cesarean delivery as well as antenatal complications, complications during delivery and neonatal outcomes between pregnant women with pre-pregnancy obesity versus normal pre-pregnancy body mass index (BMI).

Study design Cohort study.

Materials and Methods The population studied included pregnant women with singleton pregnancies of gestational age 37 completed weeks or more who were admitted to labor room, Chonburi Hospital, from May 1, 2006 to April 30, 2007. All pregnant women with pre-pregnancy BMI 25 kg/m^2 or over were enrolled. The control group included the pregnant women who were admitted to the labor room next to each studied case and had pre-pregnancy BMI 18.5-22.9 kg/m^2. Patients with previous cesarean delivery, private case and undelivered were excluded. Cesarean delivery rates as well as maternal and neonatal outcomes were compared.

Results Six-hundred and forty six patients were enrolled, 323 patients in each group. Cesarean delivery was significantly higher in obese women (RR 2.3, 95% CI 1.63-3.14). The risk of cesarean delivery was increased with increasing BMI (RR 2.2 in BMI 25-29.9 kg/m^2 and 2.9 in BMI ≥30 kg/m^2). Cesarean delivery due to cephalopelvic disproportion was significantly higher in the obese group (18% VS 8%, RR 2.23, 95% CI 1.4-3.5). Moreover, cesarean delivery due to preeclampsia in the obese group was 14-fold. Obese women had a relative risk of 5.0 (95% CI 2.3-11.1) for pregnancy-induced hypertension and 2.3 (95% CI 1.5-3.5) for large for gestational age (LGA). No significant differences were found between obesity and the risk of gestational diabetes, placenta previa, abruptio placentae, abnormal presentation, forceps extraction, shoulder dystocia, 3rd or 4th degree perineal tear, small for gestational age (SGA), macrosomia as well as low apgar score.

Conclusion Pre-pregnancy obesity is strongly associated with the risk of cesarean delivery as well as other pregnancy complications and perinatal conditions.

Keywords: obesity, risk of cesarean delivery, adverse pregnancy outcomes

Nowadays, obesity is a worldwide individual and public health issue. Globally, there are more than 1 billion overweight adults and at least 300 million of them are obese.[1] In Thailand, the Second National Health Examination Survey also revealed that 33.9% of reproductive women were overweight and almost 9% of them were obese.[2-3]

Obesity and overweight pose a major risk for chronic diseases, including type 2 diabetes, cardiovascular disease, hypertension and stroke, and certain forms of cancer.[4] The health consequences range from increased risk of premature death to serious chronic conditions that reduce the overall quality of life. In addition, pre-gestational obesity is a known risk factor for complications of pregnancy, for example, gestational diabetes, hypertension and preeclampsia, macrosomia and dystocia.[5-8] Several studies had shown association between pre-gestational obesity and the risk of operative deliveries including cesarean delivery, as well.[5-11]

Most studies addressing the relationship between pre-pregnancy body mass index (BMI) and pregnancy outcomes came from American researchers, and most of them were retrospective studies which may have many potential errors. In Thailand, there has never been published study showing influences of pre-pregnancy obesity on pregnancy outcomes before. In addition, in Asians, the cut-offs of BMI for overweight and obesity are different from the Western population.[12]

The objective of this study was to compare the rate of cesarean delivery as well as maternal complications, complications during delivery and neonatal outcomes between pregnant women with pre-pregnancy obesity and normal pre-pregnancy BMI.

Materials and Methods

The population studied included all pregnant women with pre-pregnancy BMI 25 kg/m^2 or over who were admitted to the labor room, Chonburi Hospital, from May 1, 2006 to April 30, 2007. The control group included the pregnant women who were admitted to the labor room next to each studied case and had pre-pregnancy BMI 18.5-22.9 kg/m^2.

BMI is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). Pre-pregnancy weight and height ,which were self-reported and obtained on their first antenatal visits, were used to calculate BMI, then classified according to WHO Definitions for Asian Population[12] into 1) Obese (BMI ≥25 kg/m^2) and 2) Normal (BMI 18.5 - 22.9 kg/m^2).

Exclusion criteria included 1) Gestational age of <37 completed week, 2) Multifetal gestation, 3) Previous cesarean delivery, 4) Private case, and 5) Undelivered. Written informed consent was obtained in all cases. This cohort study was approved by the hospital ethics committee.

After enrollment, maternal demographic data were collected; including medical history and antenatal complications.

The primary outcome measure was the rate of cesarean delivery, which was used to calculate sample size. The secondary outcomes evaluated were the occurrence of 1) pregnancy-induced hypertension (PIH), 2) gestational diabetes mellitus (GDM), 3) placenta previa, 4) abruptio placentae, 5) abnormal presentation, 6) instrumental delivery, 7) 3rd or 4th degree perineal tear, and 8) shoulder dystocia. And neonatal outcomes evaluated were 1) low apgar score (<7 at 5 minutes), 2) small for gestational age (SGA), 3) large for gestational age (LGA), and 4) macrosomia. SGA and LGA was defined as birth weight less than the 10th and more than 90th percentile compared to birth weight distribution in different gestational age at birth in Thailand.[13] Macrosomia was defined as birth weight of 4,500 grams or over according to ACOG 2000 criteria.[14]

Because there has never been published study showing the risk of cesarean delivery in obese pregnant women in Asia, in which the cut-off of BMI for obesity is different from Western countries, the sample size was calculated by results from a 3- month pilot study. The incidence of cesarean delivery in the obese group was 31% compared to 10% in normal BMI group. Therefore, the sample

size obtained by calculation was 75 patients in each group ($\alpha = 0.05$, $\beta = 0.1$).

Statistical analysis was performed with SPSS version 11 for Window XP (SPSS, Chicago, USA). Unpaired t-test was analyzed for continuous variables, Chi-square or Fisher exact test for categorical variables. Results were expressed as number, percentage and relative risk (RR) including the corresponding 95% confidence interval. The descriptive data were shown in mean ± standard deviation. A p-value of <0.05 was considered statistically significant.

Results

Six-hundred and forty six patients were enrolled, 323 patients per group. Maternal demographic data were presented in table 1. The obese patients were slightly older and more frequently multiparous. The gestational ages were not different between two groups.

Table 2. shows antenatal complications. The risk of pregnancy-induced hypertension was 5-times higher among the obese women (35% VS 7%, p< 0.001). The greatest difference was seen in the incidence of severe preeclampsia which was 13.2 times higher in the obese group. There were no significant differences in the rates of gestational diabetes, placenta previa, abruptio placentae or abnormal presentation.

Table 3. shows route of delivery. Cesarean delivery rate was significantly higher in obese women (29.4% VS 13%, RR 2.3, 95% CI 1.6-3.1). The risk of cesarean delivery was increased with increasing BMI (RR 2.2 in BMI 25-29.9 kg/m^2 and 2.9 in BMI ≥30 kg/m^2) (Table 4). Cesarean delivery was perform ed mainly due to cephalopelvic disproportion which was significantly higher in the obese group (18% VS 8%, RR 2.23, 95% CI 1.4-3.5). Moreover, cesarean delivery due to preeclampsia was 14 times higher among the obese women. The rate of vacuum extraction was more common in the normal BMI group (6.5% VS 11.8%, RR 0.5, 95% CI 0.3-0.9) but no significant difference was found in the rate of forceps extraction.

Table 5. shows complications during delivery and neonatal outcomes which were found to have no statistically significant difference in the rate of shoulder dystocia as well as 3rd or 4th degree perineal tear between the two groups. But the obese women were more likely to delivering larger fetuses and the incidence of LGA infants was almost 2.5-fold. No significant difference was found in the risk of delivering macrosomic or SGA infants as well as low apgar score between the two groups.

Table 1. Maternal demographic data.

	Obese BMI ≥25 (n=323)	**Normal BMI 18.5-22.9 (n=323)**	**P value**
Age, mean ± SD, years	26.8 ± 6.9	25.2 ± 6.3	0.002
Pre-pregnancy weight, mean ± SD, kgs	69.9 ± 8.9	50.2 ± 6.4	<0.001
Height, mean ± SD, cms	157.5 ± 6.1	156.6 ± 6.1	0.046
BMI, mean ± SD, kg/m^2	28.1 ± 2.9	20.5 ± 1.9	<0.001
Gestational age, mean ± SD, weeks	38.9 ± 1.2	38.7 ± 1.3	0.08
Gravida, mean ± SD	2.2 ± 1.1	1.8 ± 0.9	<0.001
Parity, mean ± SD	1.0 ± 1	0.6 ± 0.8	<0.001

BMI = Body mass index

Table 2. Antenatal complications

	Obese BMI ≥25 (n=323)	Normal BMI 18.5-22.9 (n=323)	RR (95%CI)	P value
PIH, (%)	35 (10.8%)	7 (2.2%)	5.0 (2.3-11.1)	<0.001
Transient HT, (%)	6 (1.9%)	0	-	0.01
Mild preeclampsia, (%)	3 (0.9%)	5 (1.5%)	0.66 (0.16-2.7)	0.42
Severe preeclampsia, (%)	26 (8%)	2 (0.6%)	13.2 (3.2-55)	<0.001
GDM, (%)	6 (1.9%)	5 (1.5%)	1.2 (0.4-3.9)	0.5
GDM A1, (%)	1 (0.3%)	1 (0.3%)	1.0 (0.1-16)	0.75
GDM A2, (%)	5 (1.5%)	4 (1.2%)	1.3 (0.3-4.6)	0.5
Placenta previa, (%)	3 (0.9%)	3 (0.9%)	1.0 (0.2-4.9)	0.66
Abruptio placentae, (%)	0	1 (0.3%)	-	0.5
Abnormal presentation				
Breech, (%)	9 (2.8%)	5 (1.5%)	1.8 (0.6-5.3)	0.21
Shoulder, (%)	0	0	-	-

PIH = pregnancy induced hypertension, HT = Hypertension, GDM = Gestational diabetes mellitus

Table 3. Routes of delivery.

	Obese BMI ≥25 (n=323)	Normal BMI 18.5-22.9 (n=323)	RR (95%CI)	P value
NL, (%)	199 (61.6%)	233 (72.1%)	0.85 (0.7-0.9)	0.003
Vacuum extraction, (%)	21 (6.5%)	38 (11.8%)	0.5 (0.3-0.9)	0.014
Forceps extraction, (%)	8 (2.5%)	10 (3.1%)	0.8 (0.3-2.0)	0.406
Cesarean delivery, (%)	95 (29.4%)	42 (13%)	2.3 (1.6-3.1)	<0.001
Indication CPD*, (%)	58 (18%)	26 (8%)	2.23 (1.4-3.5)	<0.001
PIH, (%)	14 (4.3%)	1 (0.3%)	14 (1.9-105.8)	0.001
Fetal distress, (%)	11 (3.4%)	6 (1.9%)	1.8 (0.69-4.9)	0.22
Breech, (%)	9 (2.8%)	5 (1.5%)	1.8 (0.6-5.3)	0.28
Placenta previa, (%)	3 (0.9%)	3 (0.9%)	1.0 (0.2-4.9)	1.0
Abruption, (%)	0	1 (0.3%)	-	0.32

* Diagnosed when there was protracted or arrest disorders in active phase of labor despite good uterine contraction.
NL = Normal labor
CPD = Cephalopelvic disproportion

Table 4. Risk of cesarean delivery in the obese group categorized by pre-pregnancy BMI

	Cesarean delivery, (%)	RR (95%CI)	P value
BMI 25 - 29.9 (N=260)	72 (27.7%)	2.2 (1.6-3.1)*	<0.001
BMI ≥ 30 (N=63)	23 (36.5%)	2.9 (1.9-4.4)*	<0.001

* compared to the normal pre-pregnancy BMI group

Table 5. Complications during delivery and neonatal outcomes

	Obese BMI ≥25 (n=323)	Normal BMI 18.5-22.9 (n=323)	RR(95%CI)	P value
3rd or 4th degree tear, (%)*	3 (0.9%)	7 (2.1%)	0.4 (0.1-1.6)	0.17
Shoulder dystocia, (%)*	14 (4.3%)	21 (6.5%)	0.7 (0.3-1.3)	0.15
Birth weight, mean ± SD, grams	3,290 ± 443	3,125 ± 372	-	<0.001
SGA, (%)	2 (0.6%)	1 (0.3%)	2.0 (0.2-22)	0.5
LGA, (%)	62 (19.2%)	27 (8.4%)	2.3 (1.5-3.5)	<0.001
Macrosomia, (%)	4 (1.2%)	0	-	0.06
Apgar score <7 at 5 minutes, (%)	3 (0.9%)	3 (0.9%)	1.0 (0.2-4.9)	0.66

* Only vaginal delivery

SGA = Small for gestational age

LGA = Large for gestational age

Discussion

Obesity is one of the major health problems worldwide. It has been known to be a major risk for many chronic diseases. This study also pointed out that, high pre-pregnancy BMI are at increased risk of having complications during pregnancy, delivery as well as neonatal complications. The rate of preeclampsia was 5 times higher among the obese women.

This study has also shown that obesity exerts significant influence on the route of delivery, especially cesarean delivery, which appears to act in a dose-dependent manner, increasing risk of cesarean delivery as BMI increases. These findings are similar to those of Robinson et al,[5] Rode et al,[6] Cedergren,[7] Ehrenberg et al,[8] Crane et al,[9] Young et al,[10] and Kaiser et al.[11] Cesarean delivery are mostly due to cephalopelvic disproportion, which may be explained by increasing deposition of soft tissues in the maternal pelvis and increasing the risk of delivering LGA infants in obese women, as well. Moreover, it was found that the rate of cesarean delivery due to preeclampsia was 14 times higher among obese women compared to women with normal BMI. The increased cesarean delivery rate in obese women may explain the fact that the authors did not find an association between shoulder dystocia as well as anal sphincter or rectal injury and obesity.

The present findings confirm those of Rode et al[6] that there were no associations between obesity and the risk of placenta previa, abruptio placentae, low apgar score at 5 minutes or forceps extraction. They reported that there was no significant difference

in the rate of vacuum extraction which was different from the present study that the rate of vacuum extraction increased in the normal BMI group. As the indication for vacuum extraction was mostly due to prophylaxis, the difference had less clinical significance.

In this study, private cases we excluded because the rates of cesarean delivery in these cases were more common than general cases due to elective cesarean delivery.

The present study is unique in that it is a cohort study which seems to have less bias than retrospective study. In this study, the cut-off of BMI was used for obesity specific for Asian population was used. This may make the data more generalizable for Asian especially Thai population than previous studies, which were done by using the WHO criteria for Western population.

There were some potential errors in the persent study including 1) error in the self-reporting pre-pregnancy weight. However previous reports comparing self-report of weight and height resulted in few corrections to BMI,[15-16] therefore, this probably did not cause significant error in this study. 2) Exclusion patients with gestational age less than 37 weeks might cause under-reporting some complications that occurred before term such as preeclampsia and preterm labor. And 3) there may be under-detection of gestational diabetes. In Chonburi Hospital, the authers performed selective diabetic screening in average and high risk women were recorded according to the fourth international workshop-conference on GDM,[17] Because patients who came to the labor room were enrolled, so selective screening might be missed in certain number of patients.

The present results stress the importance of concentrating to reduce the increasing incidence of obesity in fertile women. Obese women should receive the intensive preconceptional counseling on life-style and behavioral modifications to achieve weight loss before pregnancy. During pregnancy, it may be beneficial to monitor obese women more carefully to be able to intervene earlier if complications arise. Obesity is not a contraindication to pregnancy, but it is a sign to initiate intensive prenatal care and patient education to achieve successful pregnancy outcome.

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การศึกษาหาความสัมพันธ์ระหว่างภาวะอ้วนกับการผ่าตัดคลอด และภาวะแทรกซ้อนของการตั้งครรภ์และการคลอด ในหญิงตั้งครรภ์เดี่ยวที่ครบกำหนดคลอด

กรพินธุ์ รัตนสัจธรรม, ธีรภัทร์ จุลละพราหมณ์

วัตถุประสงค์ *: เพื่อเปรียบเทียบอัตราการผ่าตัดคลอด และภาวะแทรกซ้อนของการตั้งครรภ์ และการคลอด ในหญิงตั้งครรภ์ที่มีภาวะอ้วนก่อนการตั้งครรภ์ เปรียบเทียบกับหญิงตั้งครรภ์ที่มีน้ำหนักก่อนการตั้งครรภ์ปกติ*

วิธีการศึกษา *: ทำการศึกษาในหญิงตั้งครรภ์เดี่ยว ครบกำหนดคลอด ที่มาที่ห้องคลอด ร.พ. ชลบุรี ระหว่างวันที่ 1 พฤษภาคม 2549 ถึง 30 เมษายน 2550 โดยกลุ่มศึกษาคือ หญิงตั้งครรภ์ที่มีค่าดัชนีมวลกายก่อนการตั้งครรภ์ ตั้งแต่ 25 ขึ้นไปทุกคน และกลุ่มเปรียบเทียบคือ หญิงตั้งครรภ์ที่มีค่าดัชนีมวลกายก่อนการตั้งครรภ์ 18.5-22.9 ที่มาที่ห้องคลอดรายถัดไปหลังจากกลุ่มศึกษา ทั้งนี้จะไม่ศึกษาในผู้ที่มีประวัติเคยผ่าตัดคลอด หรือฝากทำคลอดพิเศษ เปรียบเทียบอัตราการผ่าตัดคลอด รวมถึงภาวะแทรกซ้อนระหว่างการตั้งครรภ์และการคลอดระหว่าง 2 กลุ่ม*

ผลการศึกษา *: จากผู้ป่วยทั้งหมด 646 คน พบว่า ภาวะอ้วนก่อนการตั้งครรภ์เพิ่มความเสี่ยงต่อการผ่าตัดคลอดอย่างมีนัยสำคัญ (RR 2.3, 95% CI 1.63-3.14) และความเสี่ยงจะเพิ่มขึ้น ตามค่าดัชนีมวลกายที่มากขึ้น (RR 2.2 ในกลุ่มที่ดัชนีมวลกาย 25-29.9 และ 2.9 ในกลุ่มที่ดัชนีมวลกายตั้งแต่ 30 ขึ้นไป) โดยหญิงที่มีภาวะอ้วนก่อนการตั้งครรภ์จะเพิ่มความเสี่ยงต่อการผ่าตัดคลอดจากการผิดสัดส่วนระหว่างทารกกับอุ้งเชิงกรานมารดา และจากความดันโลหิตสูงจากการตั้งครรภ์ถึง 2.2 เท่าและ 14 เท่า ตามลำดับ นอกจากนี้ภาวะอ้วนก่อนการตั้งครรภ์ยังเพิ่มความเสี่ยงต่อการเกิดความดันโลหิตสูงจากการตั้งครรภ์ถึง 5 เท่า (95% CI 2.3-11.1) และเพิ่มภาวะที่เด็กตัวโตกว่าอายุครรภ์ถึง 2.3 เท่า (95% CI 1.5-3.5) แต่ไม่พบความสัมพันธ์ระหว่างภาวะอ้วนก่อนการตั้งครรภ์ กับการเกิดเบาหวานขณะตั้งครรภ์ ภาวะรกเกาะต่ำ รกลอกตัวก่อนกำหนด ท่าเด็กผิดปกติ การใช้คีมช่วยคลอด ภาวะติดไหล่ การฉีกขาดหูรูดทวารหนักหรือทวารหนัก ภาวะเด็กตัวเล็กกว่าอายุครรภ์ เด็กมีน้ำหนักตัวมากผิดปกติ หรือค่าคะแนน APGAR ที่น้อย*

สรุป *: ภาวะอ้วนก่อนการตั้งครรภ์ เพิ่มความเสี่ยงต่อการผ่าตัดคลอด รวมถึงภาวะแทรกซ้อนหลายอย่างระหว่างการตั้งครรภ์ รวมถึงในทารกแรกเกิด*