Maternal Obesity May Drive Perinatal Outcome Differences More than Racial Differences

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Abstract

Objective: To evaluate differences in perinatal complications in obese vs. non-obese non-Hispanic Black and non-Hispanic White pregnant women.

Study Design: A retrospective cohort analysis of perinatal outcomes in non-Hispanic Black (NHB) vs. non-Hispanic White (NHW) women who were either obese with a pre-pregnancy body mass index (BMI) ≥30 or non-obese BMI < 30. Primary outcome was cesarean delivery rate. Secondary outcomes were induction of labor, preterm delivery (<37 weeks), gestational diabetes, gestational hypertension, preeclampsia and neonatal death rate. The groups were compared using the student t test or X2 test.

Results: When comparing the entire obese population to the non-obese parturient; however, there is little data on whether these health differences persist in the obese population. The primary objective herein was to determine if the rate of cesarean delivery differs by race in obese NHB versus obese NHW (non-Hispanic White) patients. Secondarily, we sought to assess racial differences in induction of labor (IOL), preterm delivery (<37 weeks), gestational diabetes, gestational hypertension or preeclampsia and neonatal death rates. We hypothesized that obese NHB women would have higher cesarean delivery rates than obese NHW women.

Methods and Methods

We performed a retrospective cohort analysis of women who delivered at The George Washington University Hospital between January 1990 and December 2003. The hospital’s computerized obstetric record system provided data on more than 50 health variables for 19,197 women who delivered between 24 and 42 weeks gestation that were collected over 14 years. Within this population we identified both non obese and obese pregnant women. Obesity as defined by the World Health Organization (BMI >30 kg/m²), is a growing pandemic in the United States [1]. The Center for Disease Control and Prevention reports that more than one third of the US population is obese and estimated that 42% of Americans will be obese by 2030 [2]. Obese pregnant women have an increased risk of adverse maternal and perinatal outcomes such as gestational diabetes, preeclampsia, stillbirths, induction of labor (IOL), cesarean delivery, macrosomia, congenital abnormalities, need for multiple attempts or failed regional anesthesia, puerperal infections, wound infection and long term sequelae for the infant such as diabetes, cardiovascular disease and obesity [3-8].

According to the Office of Minority Health, non-Hispanic Black (NHB) women have the highest rates of obesity, with 4 out 5 NHB women being classified as overweight (BMI 25-29.9 kg/m²) or obese [9]. Non-obese NHB women are also significantly impacted by a disproportionate burden of poor maternal and neonatal outcomes with well-established higher rates of stillbirth, gestational diabetes, hypertensive disorders, preterm birth and small for gestational age infants [10-14]. These facts represent health disparities; possibly preventable differences in the burden of disease that is experienced by socially disadvantaged populations [15,16].

Numerous studies have outlined racial-based health differences in the non-obese parturient; however, there is little data on whether these health differences persist in the obese population. The primary objective herein was to determine if the rate of cesarean delivery differs by race in obese NHB versus obese NHW (non-Hispanic White) patients. Secondarily, we sought to assess racial differences in induction of labor (IOL), preterm delivery (<37 weeks), gestational diabetes, gestational hypertension or preeclampsia and neonatal death rates. We hypothesized that obese NHB women would have higher cesarean delivery rates than obese NHW women.

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Statistical analysis was performed using X2 test for categorical variables and the student t test for continuous variables. Statistical analysis was performed using X2 test for categorical variables and the student t test for continuous variables. Statistical analysis was performed using X2 test for categorical variables and the student t test for continuous variables. Statistical analysis was performed using X2 test for categorical variables and the student t test for continuous variables.
significance was set at p ≤ .05. We analyzed the data using SPSS statistical software. A post-hoc power calculation was determined by using data from a recent retrospective cohort study assessing racial differences in primary cesarean deliveries in an academic medical center where whites had a cesarean section rate of 16.9% and blacks had a cesarean section rate of 20.3% [15]. Based on these values this would require a sample size of 4,166 patients to detect a difference with 80% power. This study was approved by the George Washington University Institutional Review Board, Office of Human Research.

**Results**

**Baseline characteristics**

We identified 19,197 women in our perinatal database of which 17,338 women met inclusion criteria. Among them, 7,906 (46%) were NHB and 9,432 (54%) were NHW. We included in the study 2,394 pregnant women with BMI ≥30. This represents an obesity incidence of 14%. Obese NHB women represented 11% (n=1,857) and obese NHW women accounted for 3% (n=357). There were 6049 non-obese NHB women (35%) and 8895 non-obese NHW women (51%) Non-obese NHB women were younger than obese NHW. However, there was no difference in pre-pregnancy BMI, BMI gain during pregnancy or gestational age at delivery between NHB and NHW patients (Table 1).

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<table>
<thead>
<tr>
<th>Obese Non-Obese</th>
<th>P value*</th>
<th>Obese Non-Obese</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Age (years)</td>
<td>29.2 ± 6.10</td>
<td>34.2 ± 5.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BMI</td>
<td>35.7 ± 5.80</td>
<td>34.3 ± 4.96</td>
<td>0.9</td>
</tr>
<tr>
<td>Prenatal BMI gain</td>
<td>3.8 ± 5.8</td>
<td>4.4 ± 3.7</td>
<td>0.004</td>
</tr>
<tr>
<td>Birth Weight (grams)</td>
<td>3030 ± 885</td>
<td>3272 ± 885</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>GA at Delivery (weeks)</td>
<td>37.6 ± 4.4</td>
<td>38.1 ± 3.7</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Data expressed as mean ± standard deviation or percentage. * Statistical analysis using unpaired student t-test. BMI: Body Mass Index; NHB- Non-Hispanic black; NHW- Non-Hispanic white

Table 1: Baseline Demographic data in the obese and non-obese populations by ethnic groups.

**Perinatal outcomes**

**Obese vs. non-obese**

When comparing the obese population to the non-obese population, obese women had higher risk of cesarean delivery [RR 1.96 (1.79-2.15)], induction of labor [1.80 (1.65-1.99)], diabetes [RR 3.55 (2.99-4.00)], hypertension [RR 3.96 (3.49-4.48)] and neonatal death [RR 2.09 (1.35-3.24)] compared to the non-obese population. No difference was found in the preterm delivery rate between obese and non-obese women [RR 1.02 (0.90-1.15)].

<table>
<thead>
<tr>
<th>Obese NHB vs. NHW</th>
<th>Non-Obese NHB vs. NHW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cesarean Delivery</td>
<td>0.90 (0.70-1.10)</td>
</tr>
<tr>
<td>Induction of Labor</td>
<td>1.65 (1.30-2.00)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.20 (0.80-1.60)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.60 (0.90-1.66)</td>
</tr>
<tr>
<td>Preterm Birth</td>
<td>1.27 (0.98-1.65)</td>
</tr>
<tr>
<td>Neonatal Death</td>
<td>1.20 (0.48-3.38)</td>
</tr>
</tbody>
</table>

**Obese NHB vs. obese NHW**

An increased risk of induction of labor for obese NHB women was identified when compared to obese NHW patients [RR 1.65 (1.30-2.00)]. No differences were observed in cesarean delivery rate, gestational diabetes, hypertensive disorders, preterm birth rates or neonatal death when comparing these two groups (Table 2).
Table 2: Perinatal Outcome by Obesity and ethnic group.

<table>
<thead>
<tr>
<th></th>
<th>NHB obese vs. non-obese</th>
<th>NHB obese vs. non-obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cesarean Delivery</td>
<td>RR (95% Confidence Interval)</td>
<td>RR (95% Confidence Interval)</td>
</tr>
<tr>
<td></td>
<td>1.90 (1.70-2.11)</td>
<td>1.72 (1.44-2.06)</td>
</tr>
<tr>
<td>Induction of Labor</td>
<td>2.28 (2.03-2.56)</td>
<td>1.10 (0.98-1.40)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>3.40 (2.83-4.14)</td>
<td>2.93 (2.18-3.94)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>2.56 (2.17-3.00)</td>
<td>3.36 (2.56-4.41)</td>
</tr>
<tr>
<td>Preterm Birth</td>
<td>0.90 (0.79-1.03)</td>
<td>1.44 (1.17-1.83)</td>
</tr>
<tr>
<td>Neonatal Death</td>
<td>1.33 (0.80-2.19)</td>
<td>3.08 (1.18-8.05)</td>
</tr>
</tbody>
</table>

Table 3: Perinatal Outcome by Ethnicity, NHB obese vs. NHB non-obese and NHW obese vs. NHW non-obese

**Obese NHB vs. non-obese NHB**

Obese NHB women had increased risk of cesarean delivery, induction of labor, diabetes, and hypertension compared to the non-obese NHB women. There was no difference in risk of preterm birth or neonatal death when comparing non-obese vs. obese NHB parturients (Table 3).

**Obese NHW vs. non-obese NHW**

Obese NHW women had higher risks across all variables compared to their non-obese counterparts. Obese NHW had a higher risk of cesarean delivery, induction of labor, diabetes, hypertension, preterm birth, and neonatal death compared to the non-obese NHW patients (Table 3).

Discussion

Our study evaluated perinatal outcomes by race in obese and non-obese women. In the non-obese population, NHB had increased risk of hypertension, preterm birth and neonatal death when compared with non-obese NHW; only IOL was increased in obese NHB compared with obese NHW. The obese cohort was associated with poor perinatal outcomes in obese pregnant women across ethnic groups in our study. Our data, which included a large population with almost equal proportions of NHW and NHB women, showed little difference in maternal and perinatal morbidity among obese NHB and NHW women. Health disparities between NHW and NHB pregnant women may be overridden by obesity’s effects on health variables associated with pregnancy.

While we hypothesized that cesarean delivery rates would differ by ethnicity among the obese groups, these rates were statistically similar. Almost all markers of maternal morbidity and neonatal mortality were comparable among obese women. This suggests that obesity may confer greater morbidity for NHW women than NHB women, thus erasing many health differences observed when compared to non-obese populations. The only significant difference in the obese NHB vs. NHW women was that NHW women had an increased risk of induction of labor.

This study confirms what is known in the literature about ethnic differences amongst perinatal outcomes in pregnant women [10-14]. One of these differences that is well known is in the area of preterm birth. According to the CDC report on vital statistics in 2011, the 2007 preterm birth rate for non-Hispanic black infants (18.3%) was 59% higher than the rate for non-Hispanic white infants (11.5%) [13]. Other studies report NHB to have a greater incidence of low birth weight, cerebral palsy and infant mortality [10-14]. Moreover, there is data to support that NHB women have a higher risk of primary cesarean delivery, gestation diabetes, hypertension, and a lower chance of success in trial of labor after cesarean delivery [15-17]. When analyzing our data across the population, and in the obese groups, NHW women consistently had worse perinatal outcomes than NHB women. In our non-obese NHB population, women exhibited worse neonatal and maternal outcomes when compared to non-obese NHW women. We postulate that there is more variability in the non-obese group (underweight, normal weight and overweight women); thus, the explanation of different outcomes in the different racial groups. Additionally, the data from this study confirms the additional risks in obese women compared to non-obese women across almost all variables [18-22]. The obese women identified in this study experienced higher rates of perinatal morbidity and mortality compared to non-obese women.
While the data herein confirmed that non-obese NHW women had an increased risk of neonatal death compared to non-obese NHB women, this association was not consistent when comparing obese NHW and NHB women. Rates of neonatal death among NHB women did not change despite BMI difference, whereas obesity seemed to increase three times in NHW patients. In contrast, a comprehensive population-based analysis by Salihu et al., [21] found that amongst blacks, the risk for neonatal, early and late neonatal mortality increased significantly with rising BMI; however, neonates of obese white mothers had no elevated risks for mortality regardless of maternal obesity.

A lower overall obesity rate was noted in our study compared to the US rate. This may be attributed to the time frame in which the study was conducted (1990-2003) as obesity has been worsening over the past two decades [18,21]. The George Washington University database is not yet updated with more current data. Despite the low incidence of 14% obesity in this study, the NHB pregnant population had more than three times risk of obesity than NHW women. This is similar to US national data where an analogous trend in ethnic disparity in the burden of obesity is noted [3,14]. In 2011, non-Hispanic black women were 80% more likely to be obese than non-Hispanic white women [3].

Limitations of this study include retrospective data collection and the time frame in which the data was collected given that the obesity rates likely have changed during the last decade and may underestimate the findings. The data set was missing important variables that are related to obesity. Additionally, prospective data examining other perinatal variables including protracted labor, shoulder dystocia, post-partum hemorrhage, thromboembolic disease, infection, stillbirth and neonatal morbidity such as: macrosomia, small for gestational age, respiratory distress syndrome, intraventricular hemorrhage and hypoglycemia would strengthen our knowledge and ability to counsel patients.

In our study, obesity, independent of race, was associated with increased risk of adverse perinatal outcomes. Adverse maternal and perinatal outcomes may be influenced more by obesity than maternal race. As the obesity epidemic continues unabated in the US, clinical decision making will continue to evolve. This report suggests that the parameters employed by clinicians in evaluating the safety and efficacy of labor in the obese gravida may be fundamentally different than the non-obese patient, independent of racial differences. Further study is indicated regarding the management of labor to minimize risk to mother and fetus in the obese patient.

Conflict of Interest
The authors have no conflicts of interest to report.

References