Maternal short stature: A risk factor for low birth weight in neonates

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Abstract

Low birth weight (LBW) is the most common cause of perinatal mortality, causing almost 30 percent of neonatal deaths. On the other hand, maternal short stature is known to cause a lot of obstetric complications like cephalo-pelvic disproportion and arrest of labor, intrauterine asphyxia, intrauterine growth retardation. The objective of our study was to find out whether there was any significant statistical association between maternal height and the birth weight of the neonate. We identified a group of low birth weight neonates (n=54) and a control group (n=51) of normal weight neonates at term in Mediciti Hospital over a period of 1 year and retrospectively looked the maternal heights for both groups. Inclusion criteria being mothers who delivered at term, mothers who had a hemoglobin level more than 10 gm/dl, mothers with relatively uneventful antenatal without any significant obstetric or medical complications during the pregnancy, and neonates with relatively uneventful post-natal periods without any significant pediatric or medical complications. The odds of having been born of a mother of short stature are more than three times greater for a low birth weight baby than a normal weight baby. The mean of birth weights of babies born to mothers of normal height is more than the mean of birth weights of babies born to mothers of short stature by 277.01 gm. This study reaffirms the observation that maternal height has a direct effect on the weight of the newborn and we propose that maternal short stature be identified as an independent risk factor for low birth weight.

Key words: low birth weight, maternal short stature

Low birth weight (LBW) has been recognized worldwide as one of the commonest causes of neonatal mortality. It is usually a result of preterm birth i.e., less than 37 weeks of gestation or due to intra-uterine growth retardation in full term births. It has been closely associated with perinatal mortality (30% of neonatal deaths), increased morbidity, and later consequences in the form of inhibited growth and cognitive development and chronic diseases. Infants who weigh 2,000-
2,499 gm at birth have a four-fold higher risk of neonatal death than those who weight 2,500-3,499 gm.

Various risk factors such as congenital anomalies or chromosomal abnormalities, diseases of the placenta, infections during pregnancy that affect the fetus (such as rubella, cytomegalovirus, toxoplasmosis and syphilis) have been recognized as predictors of LBW in infants. Although there is some data that maternal short stature is associated with LBW in Caucasians, there is limited information on such association among South Asian population. Maternal short stature in itself is recognized to increase the risk of obstetric complications such as cephalopelvic disproportion, arrest of labor, higher rates of cesarean sections, intrauterine asphyxia, intrauterine growth retardation and low APGAR scores. In this study we report the findings of a retrospective analysis of maternal heights and birth weights of babies to determine if a statistical association exists between them.

Materials and Methods

A case-control study was carried out on a sample of 105 neonates belonging to both genders based upon the data made available to us by the department of Obstetrics and Gynecology of Mediciti Hospital, Hyderabad.

Definition for LBW in our study: birth weight below 2500 gm.

Definition for short stature: Height of the mother 145 cm and below.

We categorized the babies in two groups depending on their birth weight:

Group 1: Babies born with low birth weight (< 2500 gm).

Group 2: Babies born with normal birth weight (≥ 2500 gm).

We identified a group of low birth weight neonates (n=54) and a control group of normal weight neonates at term (n=51) for a period of 1 year and retrospectively looked the maternal heights for both groups from the hospital records.

Inclusion criteria:

a) Mothers who delivered at term (in order to prevent conflict with pre-term low birth weight babies).

b) Mothers with hemoglobin level more than 10 gm/dl throughout the ante-natal period (in order to prevent conflict with low birth weights due to maternal anemia).

c) Mothers with relatively uneventful ante-natal period without any significant obstetric or medical complications during the pregnancy, to prevent conflict with low birth weights due to other causes.

d) Neonates with relatively uneventful post-natal periods without any significant pediatric or medical complications: to prevent conflict with low birth weights due to other causes.

Results

Out of the 54 low birth weight babies, 13 were born to mothers of short stature and 41 were born to mothers of normal stature. Out of the 51 normal weight babies, 4 were born to mothers of short stature and 47 of them were born to mothers of normal stature.

Table 1: Fischer's exact test

<table>
<thead>
<tr>
<th>Maternal height</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 145 cm</td>
<td>13</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>&gt; 145 cm</td>
<td>41</td>
<td>47</td>
<td>88</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>51</td>
<td>105</td>
</tr>
</tbody>
</table>

The odds ratio in these groups was found to be 3.72. In other words, the odds of having been born of a mother of short stature are more than three times for a low birth weight baby than for a normal weight baby. The computed p value for this study when calculated via Fischer’s exact test was found to be 0.0332 (statistically significant).

We also categorized the babies in two groups depending on mother’s height. One, babies born to mothers of normal stature and other, babies born to mothers of short stature. We calculated the p value and confidence intervals of this data by the unpaired students t-test assuming unequal variances (Welch correction).

Table 2: Differences between the birth weights (in gm) of neonates born to normal stature and short stature mothers.

<table>
<thead>
<tr>
<th></th>
<th>Birth weight in normal stature</th>
<th>Birth weight in short stature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2651.18</td>
<td>2374.18</td>
</tr>
<tr>
<td>SD</td>
<td>416.57</td>
<td>338.35</td>
</tr>
<tr>
<td>SEM</td>
<td>44.41</td>
<td>82.06</td>
</tr>
<tr>
<td>N</td>
<td>88</td>
<td>17</td>
</tr>
</tbody>
</table>
Intermediate values used in calculations: $t=2.9687$ and $df=26$. Standard error of difference=93.307. The computed two-tailed $p$ value assuming unequal variances equals 0.0063 which is statistically significant. The difference between mean of birth weights of babies born to mothers of normal height and the mean of birth weights of babies born to mothers of short stature equals 277.01 gm. 95% confidence interval of this difference range from 85.21 to 468.80 gm.

Discussion

Maternal short stature as a risk factor for low birth weight has been implicated in some studies, but not directly studied as an independent risk factor. Since the prevalence of low birth weight in developing countries is blamed on malnutrition of mother and related anemia, we matched our groups for hemoglobin levels in our study to minimize confounding. As shown by our study, there is a positive correlation between maternal stature and the birth weight of the baby. In many studies conducted previously, significant birth weight differences were found among mothers of variable heights. A study done by Zhang et al. of McGill University, Montreal, Canada, found that mothers of short stature had significantly higher prevalence of low birth weight, perinatal mortality, stillbirth and early neonatal mortality. In another study done at Johns Hopkins School of Medicine, by Witter and Luke, it was found that the infants of the shorter women were symmetrically smaller than the infants of the taller women. Ferraz et al. found an association of low height (<150 cm) with increased risk of intra-uterine growth retardation (IUGR). Peters et al. reported that among British mothers, height was associated significantly with birth weight.

A few possible mechanisms have been proposed for this association between maternal short stature and LBW. A study done by Kramer et al. hypothesized that maternal short stature may lead to shortened gestation by increasing the risk of idiopathic preterm labour. Hence short women are also more likely to have preterm labor. We matched our cases and controls for the gestational age to be at term in both groups. As shown in our study, despite being full term, babies born to mothers of short stature had a significant lower mean birth weight than babies born to mothers of normal stature, thus ruling out pre-term delivery as a cause of low birth weight in these neonates. The prevalence rates of intra-uterine asphyxia, intra-uterine growth retardation and low APGAR scores is higher in babies of short statured mothers than in those of mothers of normal stature, despite the increased level of obstetric intervention in the former group. In our study we matched the controls and cases for uncomplicated deliveries to eliminate this factor and still found a significant reduction in birth weights of babies born to mothers of short stature. Women shorter than 5 feet (153.6 cm) are more likely to have a small pelvis, which may make movement of the fetus through the pelvis and vagina difficult during labor; which results in increased rates of shoulder dystocia in short stuated women. Short maternal stature is highly associated with lower uterine volume and blood flow and as this is directly associated with risks of fetal growth restriction, cephalopelvic disproportion and caesarean delivery. The risk of these outcomes in the pregnancy may be likely modified by the newborn size. This could be a compensating mechanism for the fetus to pass through the limited space in a small pelvis of a mother of short stature. Hence, the newborn being small in size and of correspondingly lower birth weight.

Maternal short stature, as discussed above is recognized as a risk factor for a number of complications in pregnancy and parturition. As shown in our study, it can influence the weight of the baby at birth and could be an independent factor contributing towards the development of the baby. The acknowledgment of this association could help in coming up with any other involved mechanisms for LBW in short maternal stature and specific therapies and interventions aimed at reducing this phenomenon.

Conclusion

This study confirms the association of maternal short stature with low birth weight of new borns in the South Asian population. We propose that maternal short stature be identified as an independent risk factor for low birth weight so that appropriate preventive measures can be taken during the antenatal period and intra-partum period to avoid any additive risk for low birth weight in the baby thus preventing the possible hazardous consequences of low birth weight. Hopefully, with the acknowledgment of this association, specific interventions could be proposed to prevent fetal growth compromise and complications of low birth weight in neonates of mothers with short stature.

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