Original Article

Effect of Maternal Obesity on Cord Blood Glucose Level of Term Neonates

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ABSTRACT

Background: Almost all the countries of the world are facing epidemic of obesity. Occurrence of obesity in pregnant female is also increasing. Obesity changes intrauterine environment for growing fetus leading to metabolic changes in offspring. This study was done to evaluate impact of maternal obesity on fetal glycemic profile.

Aim and Objectives: To compare levels of umbilical cord blood glucose in term neonates born to mother with obesity with that of normal healthy mother.

Methodology: A total of 58 neonates born form obese mother and 78 neonates born from lean healthy mother were recruited in the study after obtaining informed consent of the mother. Maternal pre-pregnancy body mass index (BMI) was noted. Umbilical cord blood glucose was analysed. Data was compiled and statistical analysis was done.

Results: We observed no significant difference between levels of Umbilical cord glucose among cases compared with controls ($p>0.05$).

Conclusion: Neonates of obese mother may show altered cord blood glucose level compared with those from lean mothers. Such neonates may be more prone to develop metabolic complications in adult life. Identification of such babies at early age and introduction of healthy diet & lifestyle can reduce occurrence of lifestyle diseases.

Keywords: glucose, maternal obesity, pregnancy, umbilical cord blood.

INTRODUCTION

Global prevalence of obesity is alarmingly increasing. Occurrence of being over-weight is also increasing day by day.[1,2] India is also not spared from this global pandemic of obesity. Due to rapid nutritional, demographic and epidemiological transition, magnitude of burden is intensified in India.[3]

Prevalence of obesity in women of child bearing age and those with pregnancy has also increased to a greater extent. According to the National Family Health Survey (NFHS-4 - 2015-16), 21% of women between 15 and 49 years of age had a BMI greater than 25kg/m^2. 5.1 percent of these women were obese having BMI more than 30kg/m^2.[4] In 2014, the percentage of female with overweight and obesity in India was 21.7%, and India had the highest number of overweight and obese pregnant women (4.3 million), which was equal to 11.1% in the world.[5]

Obesity is a state of low-grade inflammation. Due to inflammation in adipocytes, they secrete numerous inflammatory cytokines. Imbalance between pro- and anti- inflammatory factors interferes with insulin signalling pathway.[6] This leads to reduced insulin sensitivity and development of insulin resistance (IR). Pregnancy itself is a state of insulin resistance & obesity further adds to it. Elevated IR in obese mother changes the intrauterine metabolic environment for growing fetus & can alter fetal metabolic programming.[7]

Altered metabolic programming in fetus may reflect as a change in insulin sensitivity pattern. Any alteration in insulin sensitivity can leads to alteration in blood glucose level.[8] Such neonates are at increased risk of development of metabolic syndrome & its consequences such as obesity, cardiovascular diseases, diabetes mellitus etc in adult life. Majority of risk factors for development of metabolic syndrome are modifiable such as diet, physical activity, lifestyle, smoking, alcoholism, mental / physical / social stress, etc. If identification of vulnerable persons is done by assessment of insulin resistance as early as possible, intervention and modification in such factors can reduce or postpone the occurrence of insulin resistance & its consequences.[9]

This study was done to compare levels of cord blood glucose in neonates born to mother with obesity with that of normal healthy mother.

MEHTODOLOGY

A case control study was carried out in Obstetrics & Gynaecology department, Paediatrics department and Clinical Biochemistry Laboratory. Institutional Ethical committee approval has been taken for the study. A total of 136 neonates born form women with singleton pregnancy were recruited in the study after taking informed consent from mother. Maternal vital parameters were noted. They were divided into two groups based on inclusion and exclusion criteria.

58 Neonates born from obese mother were included as cases in the study. Pre-pregnancy body mass index (BMI) was calculated from height and weight of mother. Mothers with BMI>30 kg/m^2 were considered as obese.[10] 78 Neonates born from normal healthy mother were included as controls in the study. Neonates of non-obese mothers without history of any illness were taken as controls. Neonates born from women with history of hypertension, diabetes mellitus, insulin therapy, hypoglycemic or hypolipidemic drugs intake, smoking, alcoholism, liver, cardiac or renal diseases or any other major illness were excluded from the study. Neonates of women with twins or multiple gestation were also excluded from the study.

5 ml of umbilical venous blood was drawn in EDTA bulb from double clamped cord immediately after delivery of placenta. Plasma was separated by centrifugation at 1200g for 10 minutes. Neonatal vital parameters were noted.

Analysis was done for glucose soon after separation of plasma using Glucose oxidase- Peroxidase method[11] with intra-assay and inter-assay coefficient of variation (CV) of 2.5% and 2.34% respectively. All the data was collected and compiled in Excel software by Microsoft version 2007. Statistical analysis was done with SPSS 17.0 software using appropriate statistical tests.

RESULTS

As shown in Table 1, We found significantly higher requirement of LSCS for birth of the baby in obese mothers as compared with lean mothers ($p<0.05$). We did not observe any significant difference in umbilical cord blood glucose level among cases and controls ($p>0.05$).

Table 1: Demographic and anthropometrics parameters of lean and obese mothers

Variable	Unit/Groups	Lean mothers	Obese mothers	p value
Maternal age †	Years	25.04 ± 3.85	26.35 ± 4.58	> 0.05
Pre-pregnancy BMI †	kg/m^2	21.86 ± 2.31	33.76 ± 2.45	< 0.001**
Gestational age†	Weeks	37.17 ± 1.11	37.32 ± 0.8	> 0.05
Mode of delivery ‡	Normal labour	53 (67.94%)	30 (51.73%)	< 0.05*
	LSCS	25 (32.06%)	28 (48.27%)	
Gender of the offspring ‡	Male	40 (51.28%)	30 (51.73%)	> 0.05
	Female	38 (48.71%)	28 (48.27%)	
Umbilical cord glucose	mg/dL	72.64 ± 11.14	68.51 ± 7.04	> 0.05

Note: Values are shown as Mean ± SD and frequencies. p value of <0.05 was considered statistically significant. * Significant; ** Highly significant. † Parameters analysed by Z-test; ‡ Parameters analysed by Chi-Square test. LSCS - Lower Segment Caesarean Section.

DISCUSSION

Epidemic of obesity is being faced by almost all developing and developed countries of the world.[2] A significant proportion of health budget is being consumed for management of obesity and obesity related complications. Non communicable diseases such as cardiovascular diseases, hypertension, diabetes mellitus and their complications are few of the major comorbidities related to obesity.[12]

Association of obesity with increased insulin resistance is observed in many studies.[13,14] Presence of these conditions during pregnancy can further complicate the scenario. These conditions are found to be associated with increased maternal and fetal morbidities and mortality. Furthermore, it can also affect fetal growth and metabolism in many aspects.[15,16] In the presented study, an attempt was made to identify alteration in glycemic parameters among new-borns of the mothers with obesity.

Many researchers have noted that age is one of the significant factors affecting insulin sensitivity and that with an increase in age, there is a progressive increase in Insulin resistance (IR).[17] Pregnancy itself is a state of insulin resistance. As pregnancy advances, there is increase in IR among mothers.[18] Many researchers have found significant difference in insulin sensitivity among neonates with regards to gender. Female offspring are found to have higher IR at birth as compared with male offspring.[19] In the present study, there was no significant difference in age of mother, gestational age and gender of the offspring among study groups ($p>0.05$). Matching was done for maternal age, gestational age & gender of the offspring in order to remove major confounding factor.

We found significantly higher need for operative intervention in the form of LSCS among neonates born from obese mothers. Need for operative intervention increases with increase in cephalon-pelvic disproportion.[20] Many researchers have observed relatively higher birth weight among neonates of obese mothers as compared with those from lean mothers. Elevated insulin resistance in obese mother leads to increased hepatic glucose production and lipolysis in mothers. This increases increased flow of nutrients to fetus which increases fetal insulin production. Insulin being an anabolic hormone, increased fetal growth and higher fat mass are also observed in such neonates.[21] Babies with higher anthropometric measurements are more to get obstructed due to cephalo-pelvic disproportion. Operative intervention in form of LSCS is more commonly required such babies.[20,21]

We observed lower cord blood glucose level among cases compared with controls. But this difference was statistically non-significant. Babies with higher birth weight has higher nutritional demand, that may lead to increased consumption of glucose and can lead to lowering of blood glucose level among babies with macrosomia. Regular monitoring of blood glucose level in such neonates becomes one of the critical steps in their management.[22]

Neonates with altered metabolic profile are more prone to develop complications related to insulin resistance such as metabolic syndrome, obesity, cardiovascular diseases, dia-

betes mellitus etc in adult life. If counselling and implementation of modification in diet, lifestyle, physical activity and avoidance of smoking & alcoholism are done, insulin sensitivity can be improved and complications related with it can be prevented or postponed.[23]

CONCLUSION

Present study compares level of cord blood glucose between neonates born from obese mothers with that of lean mothers. We found no significant difference in cord blood glucose level in these neonates as compared with neonates born from normal pregnancy. Identification of neonates with altered metabolic profile by simple blood glucose monitoring becomes one of the necessary steps in newborn care. Counselling and implementation of healthy diet, active lifestyle, along with avoidance of smoking, alcoholism & other addiction can prevent occurrence of lifestyle diseases and their complication.

LIMITATION OF THE STUDY

This study was done at one centre with limited number of the study subjects. Serial blood glucose monitoring can be planned at various intervals to check for glycemic alteration in neonates from obese mother. Follow up of the cases later in adult life for development of obesity and other complication is not done in the study. Prospective study with larger number of subjects from multiple centres can be done to analyse impact of maternal obesity on child's health and metabolic profile.

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