

Original Research Article

A study of incidence of respiratory distress syndrome in newborns born to mothers with gestational diabetes

Rajith M. L.^{1*}, Punyashree R.²

¹Department of Pediatrics, Sri Siddhartha Medical College, Agalakote, Tumkur, Karnataka, India

²Department of Obstetrics and Gynecology, Siddaganga Medical College and Research Institute, Tumkur, Karnataka, India

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*Correspondence:

Dr. Rajith M. L.,

E-mail: drrajithml@gmail.com

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ABSTRACT

Background: Hyaline membrane disease/RDS is an important cause for newborn morbidity and mortality. Many studies have established an association of infants of diabetic mothers (IDMs) with respiratory distress syndrome (RDS) since decades. Modern lifestyle changes have increased the prevalence of obesity in women and thus diabetes in pregnancy. Maintaining strict euglycemia is a double-edged sword in pregnancy which has been affecting the neonatal health and respiratory maturity in particular which has been associated with increased mortality and morbidity.

Methods: It was a prospective case control study done over a span of one year.

Results: Hyaline membrane disease (RDS) is significantly associated with gestational diabetes mellitus (GDM).

Conclusions: Even our study emphasized the ill effects of gestational diabetes on the respiratory development of baby. Most of the babies are manageable and outcome can be drastically improved by early diagnosis and efficient treatment. Education and anticipation of the complications and prompt referral are the need of the hour in peripheries and advancement of neonatal intensive cares in the referral hospitals is needed.

Keywords: Hyaline membrane disease, Surfactant protein, Surfactant lipids, Infants of a diabetic mother, RDS, Lung development, Hyperglycemia

INTRODUCTION

Gestational diabetes mellitus (GDM) is in the increasing trend in the recent times.^{1,2} Gestational diabetes is becoming one of the most frequent ailments that adversely affecting maternal and thus foetal wellbeing.

Throughout pregnancy maternal glucose homeostasis affects foetal growth and development.⁴ There will be physiological increase in insulin resistance (IR) in the mother during pregnancy and this physiologic state of IR increases the risk of more imbalanced glucose homeostasis

in pregnant ladies who already have IR contributing to GDM.⁶ Impaired glucose tolerance and diabetes during pregnancy is associated with multiple foetal congenital anomalies. And hyperglycaemia in mothers may be a significant teratogen to the growing fetus.^{7,8} The most important complication is diabetic embryopathy resulting in congenital anomalies. The ill effects are Hypoglycaemia, hyperinsulinism, macrosomia, RDS, preterm delivery, cardiac anomalies, hypocalcaemia, polycythaemia, hyperbilirubinemia, diabetic cardiomyopathy, macrosomia caudal regression syndrome, small colon syndrome.^{9,10}

Effect of gestational diabetes on foetal respiratory system

Hyaline membrane disease, transient tachypnoea of newborn, Apnoea are some of the common respiratory morbidities in newborns born to diabetic mother. Many studies have showed the increased incidence of these morbidities in newborns of diabetic mother compared to newborns born to non-diabetic mothers.¹¹

RDS

The primary cause of RDS, formerly known as hyaline membrane disease, is inadequate pulmonary surfactant. The manifestations of the disease are caused by the resultant diffuse alveolar atelectasis, edema, and cell injury. Subsequently, serum proteins that inhibit surfactant function leak into the alveoli. The increased water content, immature mechanisms for clearance of lung liquid, lack of alveolar-capillary apposition, and low surface area for gas exchange typical of the immature lung also contribute to the disease. Prenatal diagnosis to identify infants at risk, prevention of the disease by antenatal administration of glucocorticoids, improvements in perinatal and neonatal care, advances in respiratory support, and surfactant replacement therapy have reduced mortality from RDS. However, RDS remains an important contributing cause of neonatal mortality and morbidity, especially among the most immature infants.

Fetal hyperinsulinemia has been suggested to be associated with delayed pulmonary maturation.¹² *In vitro* cell line studies, *in vivo* animal studies with diabetic rat offspring, and clinical studies suggest hyperglycaemia and hyperinsulinemia can disrupt surfactant lipid and protein synthesis, causing delayed maturation in surfactant in IDMs. Gellis and Hsia, first described by that IDMs had increased mortality as well as the morbidity due to RDS.¹⁰ Robert et al showed that the IDMs have a five to six times greater risk of the developing RDS than those infants of the nondiabetic gestation.¹³

METHODS

Study type

It's a prospective case control study.

Study place

Study carried out at Sri Siddhartha medical college, Tumkur

Study period

Study conducted for one year period of time, from June 2022 to June 2023.

Selection criteria

All pregnant women coming for antenatal check-up and

willing to follow up at our center were included in study.

Exclusion criteria

Pregnant ladies with overt diabetes and with other comorbid medical conditions, were excluded.

Procedure

Study size was 1000. Over the study period one thousand pregnant women coming to obstetrics and gynecology department were selected, 75 pregnant women proven of gestational diabetes according to WHO criteria were included in study. Pregnant ladies with other associated comorbidities were not included in the study. They were followed up till the delivery. And occurrence of hyaline membrane disease was documented in born newborns.

Ethical approval was taken.

Statistical analysis

SPSS 20 software was used for data analysis.

RESULTS

Among babies born to GDM mothers 5 were less than 30 weeks, 16 were between 30-37 weeks, 44 were between 37-40 weeks and 10 were more than 40 weeks.

Table 1: Gestational age of the newborns.

Variables	Non-GDM, (n=925)	GDM, (n=75)
Preterm <30 weeks	39	5
30-37 weeks	48	16
Term 37-40 weeks	753	44
>40 weeks	85	10

Table 2: Birth weight of the newborns.

Variables (gm)	Non-GDM	GDM
<1000	10	5
1000-1500	65	16
1500-2500	350	44
>2500	500	10

Among babies born to GDM mothers 5 were below 1000 gm, 16 between 1000-1500 gm, 44 between 1500-2500 gm and 10 were above 2500 gm.

Table 3: Sex of the newborns.

Sex	Non-GDM	GDM
Male	485	40
Female	440	35

Among babies born to GDM mothers 40 were male and 35 were female.

Table 4: Mode of delivery.

Variables	Non-GDM	GDM
Normal vaginal delivery	600	40
Caesarean section	325	35

Among babies born to GDM mothers 40 were by normal vaginal delivery and 35 by LSCS.

Table 5: Hyaline membrane disease in GDM and Non GDM pregnancies.

Outcome	Non-GDM	GDM	P value
Hyaline membrane disease	37 (4%)	11 (14.67%)	<0.001

The 11 (14.67%) babies of GDM mothers developed RDS and 37 (4%) babies born to non GDM developed RD.

DISCUSSION

In our study the overall incidence of fetal distress syndrome in gestational diabetic group was 14.67% and in non-diabetic group was 4% and it was significantly associated. It was more common in multigravida than primigravida.

Robert et al showed that IDMs have a 5 to 6 times greater risk of developing RDS than those infants of nondiabetic gestation.¹³

In a study by Matti et al incidence of RDS was 13% in the offspring of mothers affected by pregestational diabetes and in the 5% in the offspring of gestational diabetic mothers.¹⁹

In a study by Mortier et al of 444 women neonatal RDS was diagnosed in 32 cases (7.2%). Compared to others, neonatal RDS was significantly more often observed in neonates from women diagnosed with GD: 12 (20%) vs. 20 (5.2%), respectively (p<0.001).²⁰

Kawakita et al also showed increased risks of neonatal respiratory morbidity in mothers with diabetes compared to women without diabetes regardless of probability to deliver at term, although the risks tended to be higher with a higher probability to deliver at term: RDS: aOR 1.5; 95% CI 1.3-1.7 and aOR 3.1; 95% CI 2.6-3.7, for gestational and pregestational at term, respectively (p<0.001).¹¹

According to one other meta-analysis of 24 studies from 23 available articles on PubMed, for the association between maternal DM and the risk of neonatal RDS, the pooled OR was 1.47 (95% CI 1.24-1.74), especially for cohort studies (1.39, 95% CI 1.17-1.65). The pooled OR of the risk of neonatal RDS was 1.57 (95% CI 1.28-1.93) for GDM and 2.66 (95% CI 2.06-3.44) for pre-gestational diabetes mellitus (PGDM).²¹

CONCLUSION

Maternal diabetes disrupts normal surfactant synthesis and function in neonates leading to surfactant deficiency and respiratory distress in neonates. As maternal diabetes increases the risk of RDS in infants of near-term a different other method to achieve better glycemic control is need of the hour and further understanding of the molecular processes that affect surfactant synthesis during diabetes pregnancy is also needed. Critical factors in infant of diabetic mothers who has subclinical signs of RDS should be identified and it may open up other targets for the prevention and treatment of RDS in this population.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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