

# Metabolic Complications and Outcome of Infants Born to Diabetic Mothers

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## Abstract

**Objective:** To determine the metabolic complications and outcome of infants born to diabetic mothers.

**Methods:** In this descriptive, cross-sectional study infants born to diabetic mothers were included. Detailed physical examination of the newborn to assess the general condition with emphasis on birth trauma, cardiac, respiratory system examination and skeletal deformities was carried out. Routine investigations like complete blood count, X-ray chest, metabolic profile including blood sugar and serum calcium were done of all the babies. All the study neonates suspected of having congenital heart disease underwent echocardiography once they stabilized. Outcomes whether discharge or expired was noted and association of mortality with various variables were seen.

**Results:** Forty six babies were enrolled in this study out of which males were 43.5% and females were 56.5%. Mean birth weight ranged from 1 to 5.5 kg. Majority of the babies had tachypnea at birth. The most common metabolic complications noted were hypoglycemia (73.9 %), hyperbilirubinemia (52.2 %) and hypocalcaemia (21.7 %). Six patients required mechanical ventilation and overall mortality was 8.7%

**Conclusion:** High proportion of metabolic complications is seen in neonates born to diabetic mothers. Prompt recognition and treatment of these complications can lead to improved outcome.

**Key Words:** Infants, Diabetic mother, Hypoglycemia, Hyperbilirubinemia, Diabetic Complications

## Introduction

The association of perinatal morbidity and mortality with maternal diabetes has long been recognized.<sup>1</sup> Out of all the pregnancies almost 2-3% are affected by diabetes and 90% amongst them suffer from gestational diabetes.<sup>2</sup> In fact the actual incidence of impaired glucose tolerance in pregnancy is variable

according to incidence of diabetes in that population and varies between 3-10%.<sup>3</sup> Prevalence of gestational diabetes is reported as 8% in a study from Karachi whereas a study from Faisalabad reports 2% prevalence.<sup>4,5</sup>

The state of diabetes during pregnancy is associated with a number of adverse effects in the fetus like metabolic derangements, malformations and deaths. It induces hyperglycemia and hyperinsulinemia in fetus, which results in a wide array of functional and structural abnormalities like macrosomia, visceromegaly, polycythemia, hyperviscosity and numerous congenital abnormalities.<sup>6-8</sup> Additionally metabolic problems like hypoglycemia and hypocalcaemia adversely affect the immediate neonatal period.<sup>9</sup> The incidence of hypoglycemia is reported to be 35.5%, that of hypocalcaemia 15%, hyperbilirubinemia 30% and hypomagnesaemia 4.5%.<sup>10</sup> A study in Pakistan found a combined prevalence of all metabolic diseases to be 57.7%.<sup>11</sup> The rate of congenital malformations is estimated to be around 5-6%.<sup>9</sup> One study from Pakistan has reported frequency of congenital heart defects in infants of diabetic mothers to be as high as 52.2%.<sup>12</sup>

Gestational diabetes also predisposes to higher infant mortality.<sup>13,14</sup> The mortality of infants of diabetic mothers in developed parts of world dropped from 250/1000 live births in 1960s to 20/1000 live births in 1980s.<sup>15</sup> However situation in our part of world is not so encouraging with poverty, ignorance, poor disease control and lack of perinatal and obstetric facilities leading to still high morbidity and mortality.<sup>10</sup>

## Patients and Methods

This descriptive, cross-sectional study was carried out from January 2016 to December 2016, in Paediatrics Department of P.O.F Hospital, Wah Cantt. By using the WHO sample size calculator with a population prevalence of 57.5% at 10% error that of precision sample size of (N=47) was calculated. Sampling technique was non probability consecutive sampling. All the newborns admitted in the NICU with maternal history of gestational diabetes or pre -

gestational diabetes were included in the study. A detailed physical examination of the newborn to assess the general condition with emphasis on birth trauma, cardiac, respiratory system examination and skeletal deformities was carried out at admission. Frequency tables were constructed for demographic profile of patients and chi square cross-tabulation was done to find out the association between various patient factors and mortality at a 5% level of significance. Routine investigations like complete blood count, X-ray chest, metabolic profile including blood sugar and serum calcium were done of all the babies. Polycythemia was defined as Hematocrit > 65 %. Those babies who developed jaundice were followed with serial serum bilirubin levels. For blood sugar, samples were obtained from the heel of foot by prick method and checked on glucometer at 1, 2, 4, 8, 12, 24 hours of age. Abnormal values if found were also rechecked from laboratory. Hypoglycemia was defined when blood sugar level was below 45 mg/dl. Baby was labeled as Hypocalcemic if serum Calcium level was below 2.2mmol/l. Arterial blood gas (ABG) analysis was done of the babies who had severe respiratory distress or who were on mechanical ventilation. All the study neonates suspected of having congenital heart disease underwent echocardiography once they stabilized. Outcomes whether discharge or expired was noted and association of mortality with various variables were seen.

## Results

Forty six babies who fulfilled the inclusion criteria from January 2016 to December 2016 were enrolled in this study. Total days of admission of these babies varied from 3 to 21 days. Maternal history revealed that 47.8% were primigravida. Majority of babies (87%) were born by C/section. Antenatal data showed that 34.8% mothers had pregnancy induced hypertension (PIH)/ pre eclampsia, 13% had history of polyhydromnios, Meconium stained liquor in 8.7% and history of premature rupture of membranes (PROM) and cord prolapse in 4.3% cases each. Insulin administration was reported in 4.3% of mothers. Majority of the babies were female and the mean birth weight of babies was  $3.2 \pm 1.055$  SD kg with range between 1 to 5.5 kg (Table 1). Majority had tachypnea (Table 2). CRP was positive in 17.4% cases, RDS in 34.8%, cardiomegaly in 8.7 % and Polycythemia in 4.3% cases. Hemoglobin values ranged between 14.7 to 21.9  $\pm 1.889$  mg/dl (mean 17.7) (Table 3).

**Table 1: Profile of The Babies**

Variable	No (%)
Sex	
Male	20(43.5)
Female	26(56.5)
Gestation	
Full term	32(69.5)
Prermature	14(30.4)
Birth Weight	
Less than 2.5 kg	8(17.3)
Between 2.5 to 3.9 kg	32(68.5)
4 kg and above	6(13)

**Table 2: Clinical features of babies at admission:**

Variable	No(%)
Tachypnea	20 (43.5)
Moaning	16 (34.8)
Subcostal recession	16 (34.8)
Cyanosis	10 (21.7)
Absent Primitive reflexes	10 (21.7)
Birth asphyxia	08 (17.4)
Murmur	06 (13)
Crepts	02 (4.3)
Talipes	02 (4.3)
Spine deformity	02 (4.3)
Plethora	02 (4.3)

**Table 3: Metabolic complications**

Metabolic complications	No(%)
Hypoglycemia	34 (73.9)
Hyperbilirubinemia	24 (52.2)
Hypocalcemia	10 (21.7)

**Table 4: Treatment of the babies**

Treatment	No(%)
Phototherapy	22(47.8)
Oxygen via head box	14(30.4)
CPAP	16(34.8)
Mechanical ventilation	6(13)
Surfactant	4(8.7)
10% Dextrose water	38(82.6)
12% Dextrose water	6(13)
Intravenous Steroid	6(13)

ECHO confirmed the diagnosis of congenital cardiac defects in 8 babies. Among the cardiac defects. One patient had complex heart disease (criss cross heart, VSD, Pulmonary atresia, Anomalous coronary arteries

and Aortic stenosis), 5 had Patent ductus arteriosus (PDA) and 02 each of Atrial septal defect and

Ventricular Septal Defect. Blood sugar was normalized in 21.7% within 24 hours whereas in 78.3 % normalization occurred after 24 hours of treatment (Table 4). Overall mortality was 8.7%. Expired babies had tachypnea, cyanosis, moaning and subcostal recessions at birth (Table 5).

**Table 5: Factors associated with mortality**

Variable	Outcome		Chi square/likelihood ratio	p-value
	Discharged	Expired		
Gestation				
Full term	32	0	10.4	0.002
Premature	10	04		
Birth weight				
Low birth weight	06	02	21.6	0.03
Normal birth weight	30	02		
Macrosomia	06	0		
Respiratory rate				
Less than 60	26	0	7.16	0.01
More than 60	16	04		
Cyanosis				
Present	6	4	13.7	0.000
Absent	36	0		
Moaning				
Present	12	04	9.1	0.004
	30	0		

## Discussion

Diabetes mellitus is a global health problem and diabetes in pregnancy leads to various obstetrical complications and fetal anomalies. A large number of babies ( 87 %) were born via C-section in our study which is in comparison with a Nigerian study(74.3%) but high as compared to a local studies in which it was 55%.<sup>16, 10</sup> Among maternal co morbid factors, PIH/eclampsia was found to be more common as also noted by Abu-Heija AT.<sup>17</sup> Poor maternal glucose control is associated with increased risk for prematurity. In our study, 30.4 % babies were born prematurely whereas only 11.9 % cases were found in a Peshawar study.<sup>18</sup>

Macrosomia is considered as a common complication of diabetes during pregnancy. It not only results in increased chances of cesarean section but also results in shoulder dystocia, brachial plexus injury and birth

asphyxia. The pathophysiology of excessive fetal growth is complex and is hypothesized to be due to increased adiposity and visceral organ hypertrophy.<sup>19</sup> In our study majority of babies were of normal weight (69.5%) and only small percentage of macrosomic (13%) and low birth weight babies (17.3%) was found which is in comparison with another author.<sup>11</sup>

Diabetes leads to deficiency of surfactant in fetus resulting in respiratory distress syndrome (RDS) thus contributing in mortality of the newborn. A large number of babies had respiratory symptoms at birth in our study and RDS was found in 34.8% of the cases which is a high proportion but in accordance to the study by Malak.<sup>20</sup>

Hypoglycemia was the most common metabolic complication found in our study. This hypoglycemia in initial neonatal period is due to the carry over state of the fetal hyperinsulinemia. Incidence of hypoglycemia varies in various studies. Number of hypoglycemic babies in our study was high as compared to Haider et al but similar to Girish.<sup>4,21</sup> The other metabolic complications like Hyperbilirubinemia and Hypocalcemia were also high in our study as compared to an Indian study.<sup>22</sup> Birth asphyxia not only results in long term neurodevelopmental outcomes of a baby but also results in neonatal mortality. In our study it affected 17.4% cases which are low as compared to a Karachi study.<sup>5</sup>

In the current study, 17% babies had congenital heart defect which is low as compared to a study by Demirpence et al but high when compared to the local study.<sup>18,23</sup> No case of cardiomyopathy was found in our study as found by other authors.<sup>24, 25</sup>

The overall mortality of our study is similar to that found in other local study.<sup>10</sup> Mechanical ventilation has proved to be a life saving intervention in cases with respiratory compromise in acute care settings but a high incidence of complications leading to mortality have also been documented.

The mortality in our study was statistically high in cases that were on mechanical ventilation due to respiratory complications and sepsis as also observed by Qazi et al.<sup>26</sup> Premature babies have immature organs and tissues and are prone to develop acute and long term complications. A high incidence of mortality was seen in premature babies who are also observed by other national and international studies.<sup>1, 27</sup> The limitation of the study was its small sample size; therefore multicenter larger studies should be done to find the incidence of various complications in our population.

## Conclusion

1. Children born to diabetic mothers have a high incidence of fetal, perinatal and neonatal complications.
2. Better glycemic control during pregnancy can lead to improved outcomes in terms of morbidity and mortality.

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