

## Complications and Immediate Outcome of Pregnant Diabetic Women

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### Summary:

**Aim:** To see complications and immediate outcome among pregnant diabetic women.

**Methods:** This observational retrospective study included sixty nine pregnant women with diabetes (both pre-gestational and gestational diabetes) those who got admitted and treated at Dhaka Medical College Hospital (DMCH), Dhaka Bangladesh from the 1<sup>st</sup> August 2007 to the 31<sup>st</sup> August 2008. Detailed analysis of their obstetric history, ante partum and intra partum complications and mode of delivery were performed.

**Results:** Majority of the women (76.92%) were admitted through labor emergency. Mean age of the women was 28.9 (18-45) years. Fifty four (54%) percent of women belonged to 21-30 years age group. Sixty two (62.31%) percent of women had gestational diabetes whereas 37.68% had pre-gestational diabetes. All women were followed up both by obstetrician and diabetologist. Twenty five percent(25%) women developed pre-eclampsia and pregnancy induced hypertension, thirteen percent(13%) women developed

premature rupture of fetal membrane(PROM), twenty three percent (23.25%) women had fetal distress, three(2.88%) percent women present with ante-partum hemorrhage(APH) and one percent(1.44%) women develop acute polyhydramnios. Average gestational age was 36.83(41-28) weeks. Sixty percent (60%) delivered after 37weeks of gestation and forty one (40.58%) delivered before 37weeks of gestation. Ten percent women delivered vaginally and ninety percent (90%) women delivered by caesarean section (CS) because of post CS, repeat CS, breech presentation, preeclampsia, fetal distress and obstructed labor. Maternal mortality is 1.44% and peri-natal is mortality 8.62%.

**Conclusion:** Ante-partum and intra-partum complications are more common among pregnant diabetic women. Knowledge of the importance of maternal glycaemic control, as well as development of surveillance techniques to prevent complications, resulted in a decline in fetal and neonatal mortality.

**Key word:** Pregnancy, diabetes, complications, outcome.

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### Introduction:

Diabetes mellitus is the commonest endocrine disorder during pregnancy and it complicates about 1-2% of all pregnancies<sup>1,2</sup>. Prior to the introduction of insulin,

perinatal mortality from this complication was the order of 65%<sup>1,2,3,4</sup>. This has fallen drastically with the introduction of medical obstetric clinic, to a level almost equal to that in non diabetics provided glycaemic control is good and tight<sup>1,2,3,4</sup>. In fact many pre-diabetics (IFG and IGT) and potential diabetics may show chemical evidence of Diabetes mellitus during the course of metabolic stress of pregnancy. In case of Gestational Diabetes Mellitus (GDM), where glucose homeostasis return back to normal after delivery. It increases various risk to the mother and fetus. The duration and severity of maternal diabetes mellitus and quality of its control during pregnancy determine the outcome of pregnancy<sup>5,6</sup>. Pre-eclampsia occurs approximately twice as frequently in diabetic as non-diabetic pregnancies<sup>3</sup>. The risks of preterm labour are three fold higher than that in non diabetics<sup>1,4,7</sup>

Fetal surveillance is important but there is no reliable method for this (ante partum and intra partum). A

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combination of methods must therefore be employed. The value and nature of ante partum fetal monitoring in well controlled GDM remain poorly defined, it is generally accepted that antenatal fetal monitoring may minimize the risk of adverse outcome in complicated pregnant women<sup>2</sup>. There is no universally agreed monitoring method<sup>1,2,3,4</sup>.

Risk factors for the occurrence of still births included poorly controlled diabetes, fetal macrosomia, co-existing vasculopathy or pre-eclampsia and hydramnios<sup>1,2,8</sup>. In the past, sudden still birth and unexplained IUD were more common after the 36th week of gestation<sup>1,2</sup>. Hyperinsulinaemia and frequent fluctuations in random glucose level have been described as being responsible for the still Birth<sup>1,4</sup>. Vasculopathy induced reduced uterine blood flow and hyperinsulinaemia both causes fetal hypoxia. With better and tighter control of blood glucose level, the incidence of still birth falls dramatically, although it is still higher than in non-diabetic pregnancies<sup>1</sup>. Infant of diabetic mother have 6-9% risk of major congenital anomalies<sup>3</sup>, 4% risk of respiratory distress syndrome and 28% risk increased of macrosomia and cardiomegaly(30%)<sup>9</sup>. Macrosomia (birth weight>4000gm) may result in incidence of primary caesarean section<sup>1</sup> or obstetric trauma such as fractured clavicle, Erb's palsy or phrenic nerve palsy due to shoulder dystocia.<sup>2,3</sup>

The timing of delivery in diabetic pregnancies remains controversial. Delivery should be delayed until fetal maturation has taken place, provided that the patient's diabetes is well controlled and antepartum surveillance remains normal. There is little evidence from randomized controlled trials to support either elective delivery or expectant management at term. Many units adopt the policy of elective induction at 38-39 weeks provided the diabetes is well controlled and there is no associated fetal or maternal complication<sup>1</sup>. In presence of complication (either maternal or fetal), delivery should be expedited<sup>2</sup> when the risk of continued intrauterine existence are thought to exceed those of premature delivery particularly respiratory distress syndrome and hyperbilirubinaemia<sup>3</sup>. Where glycemic control is good and there is no supervening complication (e.g. abnormal fetal growth) there is no reason to deliver the fetus before 40 weeks of gestation. But some authorities agree that once maturity is achieved, there is little value in delaying delivery<sup>1,3</sup>. As pregnancy advances, risk also increases

despite good glycaemic control. The major risks are related to operative morbidity, consequent on fetal macrosomia and obstructed labor. The rate of caesarean section in diabetic pregnancies is significantly higher<sup>1,2,3,4</sup> than that in non-diabetic pregnancies, and may be as high as 50 percent<sup>1</sup>. This is partly due to fetal macrosomia with a consequent fear of shoulder dystocia complicating macrosomic vaginal deliveries, fetal distress and also due to failed induction of labors.<sup>1,3</sup> Incidence of fetal distress is high because labor pain stimulates catecholamine<sup>2</sup> release causing glycogenolysis and hyperglycemia. On the other hand uterine contraction causes impaired maternal oxygen release in the utero-placental circulation<sup>1,3</sup>.

#### **Aims and Objectives:**

The study was designed to find out the complications and immediate outcome of pregnant diabetic women in the third trimester and to compare the results between gestational (GDM) and pregestational (PDM) diabetic women in labor ward of Dhaka Medical College hospital (DMCH), Dhaka.

#### **Methods:**

This was a retrospective study done in DMCH from the 1st August 2007 to the 31st August 2008. Data were collected from admission register, patient's file, OT register and report book. During this period total 15283 women were admitted in labor emergency. Among them, 69 had Diabetes Mellitus (PDM and GDM). Irrespective of blood glucose level, all women with pregnancy less than 37 weeks received a course of steroid for fetal lung maturity<sup>3</sup>. Last menstrual period (LMP) and early ultrasound were used for confirmation of duration of gestation. All women with severe pre-eclampsia received a loading dose of magnesium sulphate. Maternal kick count, auscultation of fetal heart sound were used to diagnose fetal distress. We analyzed maternal and fetal complication and outcome depending on type of diabetes and duration of gestation.

#### **Results:**

Among 69 pregnant women with diabetes, 43(62.31%) had gestational diabetes (GDM), 26 (37.68%) women had pregestational diabetes (PDM). Fifty-nine percent (59.42%) women progressed to term pregnancy where in 40.58 % pregnant women ended before 37 weeks of gestation. Average pregnancy duration 36.80(28-41)

weeks. Table-I: showed general characteristics of the patients. Table II: showed age and parity distribution of patients. Mean age of the women was 28.9 (18-45) years. Fifty four percent (53.73%) women belonged to 18-29years age group and 43% percent belonged to 30-39years age group. Twenty four percent women were primi gravida, 21% women were 2<sup>nd</sup> gravida, 26% women were 3<sup>rd</sup> gravida and 29% women were 4<sup>th</sup> gravid and or above. Total 17 (25%) women out of 69 developed hypertensive disorder of pregnancy (PIH and PE). Nineteen percent (19%) women of GDM developed PE in comparison to 35% women of PDM, although the difference is not significant statistically ( $p>0.076$ ) as shown in **table III**. Sixteen percent (16%)

women of GDM developed PROM (preterm rupture of membrane) in comparison to 8% women of PDM. The difference is not significant statistically ( $p>0.185$ ). One woman of PDM developed severe poly-hydramnios and two women ante-partum hemorrhage (APH). Ten (23.25%) women of GDM developed ante-partum fetal distress in comparison to six (23%) women in PDM, although the result is not significant statistically ( $p>0.231$ ). Total 62 (90%) women were delivered by cesarean section (CS) as compared to 7(10%) by vaginal delivery. Thirty seven (86%) women of GDM and 25(96%) women of PDM were delivered by cesarean section. The result is not significant statistically ( $p>0.231$ ). One woman of PDM with PE with IUD died

**Table-I***Shows patient's general characteristics*

Variables	No of patients(n=69)
Age	28.9(18-45)yrs
Average gravidity	3.03
Average parity	1.38
Gestational age	36.80(28-41)weeks
Term	41(59.42 %)
Preterm	28(40.58 %)
Gestational diabetes(GDM)	43(62.31 %)
Overt diabetes(PDM)	26(37.68 %)

**Table-II***Distribution of women according age & Parity (n=69)*

Age range	PDM	GDM	Total
18-29yrs	15	21	36(53.73%)
30-39yrs	10	19	29(43.28%)
>40yrs old	1	1	2(2.98%)
Primi gravida	8	8	16(24.24%)
2 <sup>nd</sup> gravid	5	9	14(21.21%)
3 <sup>rd</sup> gravid	6	11	17(25.75%)
4 <sup>th</sup> ≥gravida	7	12	19(28.78%)

**Table-III***Pregnancy outcome depending upon type of diabetes. (n=69)*

Variables		GDM (n=43)	PDM (n=26)	Total N=69	P-value	Comment
Pre-eclampsia	Yes	8	9	17	0.076	Not significant
	No	35	17	52		
PROM	Yes	7	2	9	0.185	Not significant
	No	36	24	60		
Fetal Distress	Yes	10	6	16	0.231	Not significant
	No	33	20	53		
CS		37	25	62	0.147	Not significant
Vaginal Delivery		6	1	7		
Maternal death	Yes	0	1	1	0.377	Not significant
	No	43	25	68		
Intrauterine death	Yes	3	2	5	0.357	Not significant
	No	40	24	64		

Level of significance 5%

due to septicemia. Regarding peri-natal outcome, Table (III and IV) showed that live birth 64(91.38%) and IUD 5(8.26%). The occurrence of IUD was higher among GDM as compared to that of PDM (3 and 2 respectively). There were five IUD. Among them four had preeclampsia and in one the cause was unknown. The result is significant statistically ( $p < 0.01$ ). Average fetal weight 2.89(1.5-3.9) kg. Twenty six percent neonates had weight less than 2.5 (1.5-2.4) kg and remaining 74% had normal birth weight (2.5-3.9kg). There was no case of macrosomia. Nine women had previous bad obstetric history and eight remained uncomplicated in current pregnancy. One woman of GDM had previous history of five IUD and her current pregnancy also ended with IUD. Table V showed indication of caesarean section. Twenty two women had

history of previous CS, 5 had breech presentation and 37 women developed ante partum and intra partum fetal distress and delivered by CS. Two women had ante partum hemorrhage. Four percent (4.4%) neonate had severe birth asphyxia and required admission at special care baby unit and 95.55% had normal APGAR score. Table VI showed pregnancy outcome depending upon complications among PDM and GDM. Among 69 pregnant diabetic women, 49(20+29) women developed complications and 20 (6+14) women remain uncomplicated. Occurrence of PE and fetal distress among complicated PDM and GDM pregnancy are significant ( $p$  value are 0.020 & 0.011 respectively). Presence of complication also determine duration of gestation and this change is also significant ( $p$  value is 0.004)

**Table-IV***Shows fetal outcome (n=58)*

Variables	Results
Live birth (91.38%)	Average birth weight 2.89kg Normal weight baby(2.5-3.99kg)—73.59% Low birth weight baby(less than 2.5kg)—26.41%
APGAR score	7 and/ or more — (43) 95.55% Less than 6 —(2) 4.44%
IUD (8.62%)	Pre-eclampsia 4(80%) Unknown 1 (20%) 0.01(P value)

**Table V***shows Indication of Cesarean section (n=62)*

Indication of Cesarean section	No of case
Previous one Cesarean section	17
Repeat Cesarean section	5
Pre-Eclampsia & PIH	16
Intra partum fetal distress	10
Breech presentation	5
Large size baby(weight more than 3.5kg),head high up	6
Ante partum fetal distress(LFM , Oligohydramnios)	6
Bad obstetric history/repeated Pregnancy loss	2
Ante partum hemorrhage	2
Obstructed labor	1
Total	68

\*There was overlapping of indications.

**Table -VI**

<i>Pregnancy outcome depending on complication.</i>						
Variables		Normal (n=20)	Abnormal (n=49)	Total (n=69)	P-value	Comments
Pregestational diabetes		6	20	26	0.156	Not significant
Diabetes(PDM)						
Gestational Diabetes(GDM)		14	29	43		
PE and PIH:	Yes	7	9	16	0.020	significant
	Not	38	13	51		
Fetal distress	Yes	2	6	8	0.011	significant
	Not	43	16	59		
PROM:	Yes	6	2	8	0.288	notsignificant
	Not	39	20	59		
Gestational age	≥37 weeks	19	22	41	0.004	significant
	≤37 weeks	4	24	28		

Level of significance 5%

#### **Discussion:**

Diabetes is a common medical complication of pregnancy; it is no longer a barrier to conception. The presence of diabetes (gestational and pre gestational diabetes) in pregnancy has been associated with adverse effects on maternal and neonatal outcomes <sup>4</sup>. The incidence of obstetrical and metabolic complications increased, and a continuum has been observed between maternal blood glucose levels and perinatal outcome perinatal mortality, severe congenital malformations, prematurity, and macrosomia <sup>1,8</sup>. Diabetes mellitus is prevalent among 4.8% people of Bangladesh and prevalence of IGT is 8.5%<sup>10</sup>. Among them a significant number are female. Gestational diabetes mellitus (GDM) develops among 6.7% of all pregnancies in our population<sup>11</sup>. In western world 2 to 3% of all pregnancies are currently being diagnosed as GDM <sup>12</sup>. In this study, total number of pregnant diabetic women was 69 and among them 43(62.31%) were GDM and 26(37.68%) were PDM .C B Mahmood <sup>9</sup> in his study of 52 diabetic mother reported that 59.61% had GDM and 40.38% had PDM. The same were found in Begum A <sup>13</sup>and Begum N <sup>14</sup> study. Forty one (59.42%) Women delivered after 37 weeks gestation compared to 28(40.58%) before 37 weeks gestation in this study. Pregnant diabetic women may need to be delivered prematurely due to maternal or fetal problem<sup>2</sup>. C B Mahmood<sup>9</sup> and Ranade *et al* <sup>15</sup> reported 7.6% and

36%of preterm delivery respectively in their study. In this study ,90% women delivered by caesarean section (CS) compared to10% by vaginal delivery (VD).<sup>9, 16</sup> S. Mahmuda<sup>17</sup> found 30.23% VD and 69.76% CS, Roksana <sup>18</sup> found 57.45%CS, Metal S reported 38.3%CS, Kasiki OA<sup>19</sup> reported 64.5% VD and 35.5%CS in their study. Regarding perinatal mortality, in this study it was 8.62%. S. Mahmuda <sup>17</sup>found 9.30%, Roksana<sup>18</sup>found 12.77%, Lutale JK et al <sup>20</sup> reported 10% and Huddle K et al<sup>21</sup> reported 6.1% in their study.

The mean birth weight was 2.9(1.5-3.9) kg in the present study. C B Mahmood <sup>9</sup>, Ranade *et al*<sup>15</sup>, Mohsin F<sup>16</sup> in their study found the mean birth weight of IDM to be 3212±563, 3038±69 and 2970±636gm respectively. In this study there was no case of macrosomia and congenital malformation. Incidence of macrosomia among infant of diabetic mother (IDM) has been reported to be in the range of 20 to32% by C B Mahmood<sup>9</sup>, Gabee *et al* <sup>22</sup> and Elliot *et al* <sup>23</sup>.Among different pregnancy complications, preeclampsia is commonest and dangerous <sup>1,2,3,4,7</sup>. In this study 17(25%) women had preeclampsia and 4(80%) IUD occurred among pre-eclamptic women. One woman developed left heart failure and admitted in CCU and one woman developed severe PPH, needed caesarean hysterectomy. Occurrence of PE was higher among PDM<sup>2,7</sup> mother as compared to that of GDM mother( 35% and 19% respectively) but the difference was not significant

statistically ( $p > 0.076$ ). Incidence of pre-eclampsia among pregnant diabetic women were 9.3%<sup>17</sup>, 21.27%<sup>18</sup>, 9.9%<sup>24</sup> and 10.82%<sup>25</sup> found in different studies.

Published data showed incidence of polyhydramnios was 20%<sup>26</sup>. In this study, there was only one case of polyhydramnios. Different study showed the incidence were 6.97%<sup>17</sup>, 7.2%<sup>27</sup> and 3.7%<sup>28</sup>. Bivariate analysis (table VI) revealed strong association between pregnancy outcome, peri-natal loss ( $p < 0.01$ ), gestational age ( $p < 0.004$ ), and pre-eclampsia ( $p < 0.003$ ). This study revealed that majority of the patient delivered by cesarean section CS. This might be due to the fact that majority of the patient came with complications such as PIH, pre-eclampsia, IUGR, less fetal movement, bad obstetric history, oligohydramnios and history of previous CS and at the same time previous obstetric history, present pregnancy status, blood glucose level and lack of monitoring facility in the labor ward.

As a result cesarean section rate increased incidence of birth trauma reduced and rate of premature delivery increased<sup>1,4</sup>.

#### Conclusion:

Pregnancy in women with diabetes is a high risk one and care must be taken with an aim that both expectant mother and baby must be safe as in a non diabetic person. The abnormal fetal outcome can be changed to a normal acceptable one by pre-pregnancy counseling, optimum antenatal care<sup>29</sup>, adequate screening of risk factors followed by proper and timely use of obstetric interventions.

#### List of abbreviation:

Bad Obstetric history (BOH) Less fetal movement (LFM), Antepartum hemorrhage (APH), Premature rupture of membrane (PROM), Post partum hemorrhage (PPH), Low birth weight baby (LBW), Intrauterine death (IUD), infant of diabetic mother (IDM).

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#### Reference:

1. Justin C. Konje; Diabetes Mellitus. Obstetrics and Gynaecology-An evidence-based text for MRCOG: Arnold, Member of the Hodder headline group. www.

arnoldpublishers.com; 1<sup>st</sup> edi; Oxford University press; 2004; 47-51.

2. Mark B, Steven G; Diabetes Mellitus. Medical Disorder During Pregnancy, 3<sup>rd</sup> edi, Harcourt (India) private Ltd, New Delhi, 71-94.
3. Carla Janzen, MD, Jeffrey S Green spoon, MD, Sue M Palmer, MD. Diabetes Mellitus and Pregnancy. Current obstetric Gynecologic Diagnosis and treatment. 8<sup>th</sup> edition. Appleton & Lange, USA. 1994; 326-37.
4. M.D.G Gillmer & P.A Hulrey: Diabetes and Endocrine disorder in Pregnancy; Dewhurst's Textbook of Obstetric and Gynaecology for post graduates; 6<sup>th</sup> edi: Blackwell Science Ltd ; 197-06
5. Meherbansingh, editor, Care of the newborn, 4<sup>th</sup> edi. New Delhi, India, 1991; 70-71.
6. Davidson's principle and practice of Medicine. Diabetes in pregnancy; 20<sup>th</sup> edi, Churchill living stone; 2006; 826.
7. Andrea CScharfe, Jude P Crino: Diabetes Mellitus; The Johns Hopkins Manual of Gynecology Obstetrics; 2<sup>nd</sup> edition, 2000; Lippincot Williams & Wilkins, USA, p175.
8. Pickup JC, Willium G, editors. Pregnancy and diabetes mellitus. In: Text book of diabetes. 2<sup>nd</sup> ed. London: Blackwell Science Ltd; 1997; 72:1-28.
9. CB Mahmood, MI Kayes; Problems and Immediate outcome of infants of Diabetic Mothers: *J. Bangladesh College of Phys Surg* 2008; 26:2; 57-72.
10. Khan A, Mahtab H, Grant J, Stewart M, Ahmed T, Haq A; Diabetes Mellitus: Certificate Course on Diabetology, Distant Learning Project; 2<sup>edi</sup>, 2007. Dhaka, Diabetic Association of Bangladesh, p22.
11. Tofail A, Rhaman H, Karim A Kabir. Screening of gestational Diabetes Mellitus (abstract no. 850), *Diabetologia* 1997; 40 (supl 1).
12. Kuhl C. insulin secretion and insulin resistance in pregnancy and GDM. *Diabetes* 1991; 40:18-24.
13. Begum AJS. Anthropometric measurement of newborn babies of diabetes and non diabetic mothers in two selected hospital of Dhaka (dissertation). Dhaka: National Institute of Preventive and Social medicine, 1997.
14. Begum N.N. Study of congenital malformation in the newborns of diabetic mothers-A hospital based study (dissertation) Dhaka: Institute of Postgraduate Medicine and Research, 1998
15. Ranade AY, Marchant RH, Bajaj RT, Joshi NC; Infant of Diabetic Mother: an analysis of 50 cases. *Indian Paediatr*, 1989; 26:366-70.
16. Mohsin F. Glucose and calcium profile in infants of diabetics mothers-An analysis of 100 cases-A hospital based study (dissertation) .Dhaka .BSMMU, 1999.
17. Mahmuda Sultana: "Pregnancy with Diabetes" A clinical study in DMCH; Dissertation, No 03951WQ248M215p;

- Library Bangladesh College of Phys Surg 2005.
18. Ivy R. Management and outcome of pregnancy with diabetes mellitus (dissertation) BCPS, 1995
  19. Kasidi OA. Outcome of pregnant diabetic patients in Bangladeshi (Libya) from 1984 to 1991. *Diabetes Res Clin Pract* 1993; 21:39-42.
  20. Lutale JK. Outcome of Pregnancy in Diabetic patients in Darsalam. *Diabetes Med* 1991; 9:881-9.
  21. Huddle K, Englard M, Nagor A. Outcome of pregnancy in diabetic women in Soweto. *Diabetes Med* 1993; 10:290-294.
  22. Gabbe SG, Meshman JH, Freeman RK. Management and outcome of pregnancy of class A diabetes mellitus. *Am J Obstet Gynecol* ; 1977; 127: 465-70.
  23. Elliott JP, Garite TP, Freeman RK. Ultrasonic prediction of fetal macrosomia in diabetic patients. *Obstet & Gynecol*; 1982; 60:159-63.
  24. Graner PR, Alton D, Dudley DK. Pre-eclampsia in diabetic pregnancies. *Am J Obstet Gynecol* ; 1990; 163: 505-508.
  25. Jesmin S. The incidence, predisposing factors, complication and outcome of pre-eclampsia in diabetic pregnancy (dissertation) BCPS, 2003.
  26. Adeed N. Current trend in the management of diabetes pregnancies in Ratnam SS, Rao KB, Arulkumaran S Ed. *Obstetrics and Gynecology for postgraduates*. 2<sup>nd</sup> ed. 1999: 68-77.
  27. Dutta R, Kulenthran A. Management and outcome of pregnancy with diabetes mellitus; experience at the university hospital, Kuala Lumpur, Asia *Oceania. J Obstet & Gynecol*; 1998; 14:301-308.
  28. Metal S. The diabetic pregnancy: Review of management and results over seven year's period. *Asia Oceania. J Obstet & Gynecol*; 1987; 277-282.
  29. Helen R Murphy, Rosemary C Temple & Jonathon M Roland; improving outcome of pregnancy for women with Type 1 and Type 2 Diabetes. *The British Journal of Diabetes and Vascular Disease*; 2007; p7, 38(<http://dvd.sagepub.com>).